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Technical Article-1

Study of Payload for Komatsu HD785-7 Dump Trucks at Khondbond Iron Mine

Anup Kumar Roy (Area Manager -Safety Khondbond Iron & Mn Mine)

Introduction:

Komatsu HD785-7 Dumper is a heavy-duty dump truck used in mining operations. It is powered by a Komatsu SAA12V140E-3 engine with a net horsepower of 879 HP. The dump truck has a payload capacity of 91 metric tons and a body capacity of 60 cubic meters (Heaped 2:1). It is known for its durability, reliability, and efficiency. Khondbond Iron Mines operates 10 dump trucks to mine



out the ROM and overburden material. One of the critical factors that determine the productivity of this dumper is its payload capacity. Payload capacity refers to the amount of material that the dumper can carry in a single trip. Therefore, improving the payload of this dumper will significantly enhance its performance and efficiency.

When fully loaded, the Komatsu HD785-7 dump truck has a load distribution of approximately 31.5% on the front axle and 68.5% on the rear axle. It is important to note that the load distribution may vary depending on the specific configuration of the dump truck and the type of payload being transported. Additionally, the load distribution may need to be adjusted based on the terrain and driving conditions to ensure optimal performance and safety.

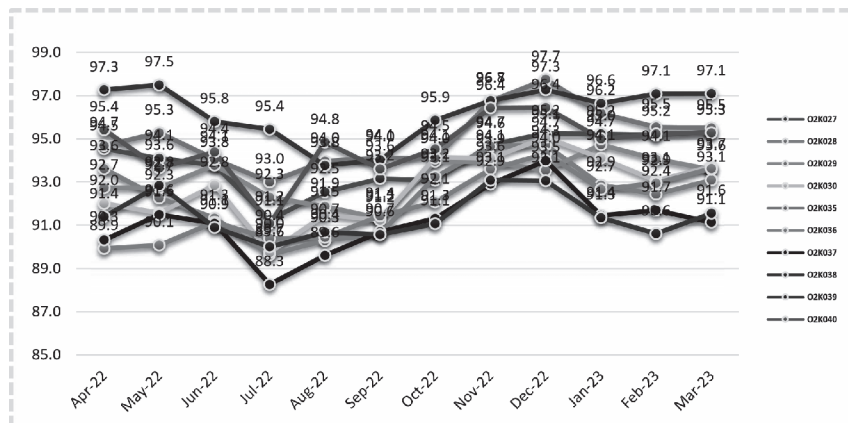
Factors Affecting Payload:

There are several factors that affect the payload capacity of a dump truck. These include the size and weight of the vehicle, the type of material being carried, the terrain, and the environmental conditions. In the case of Komatsu HD785-7 Dumper, the following factors affect its payload capacity:

1. **Weight of the vehicle:** The weight of the dumper itself reduces the amount of material that it can carry. Therefore, reducing the weight of the vehicle can increase its payload capacity. Empty vehicle weights around 72.30 tons and Gross weights was 163.3 tons with maximum load carrying capacity 91 tons.
2. **Engine Power:** The engine power of the dumper determines its ability to carry heavy loads. A higher engine power will enable the dumper to carry more material. Engine having Gross Horsepower of 895 kW.
3. **Suspension System:** The suspension system of the dumper affects its ability to carry heavy loads over rough terrain. A robust suspension system will enhance the dumper's payload capacity. Dumper is having Mac person type independent suspension at axle and hydropneumatics types of suspension system.
4. **Dump Body Capacity:** The size of the dump body determines the amount of material that the dumper can carry. Increasing the size of the dump body will increase the dumper's payload capacity.
5. **Blast Fragmentation:** Blast fragmentation refers to the size and distribution of the rock fragments produced during blasting. When the rock is fragmented into smaller pieces, it can increase the overall weight of the material being hauled, potentially reducing the payload capacity of the dumper.
6. **Face Dimension:** Face dimension is another important factor that can impact the payload capacity of dumpers. A larger face dimension typically means that more material needs to be hauled, which can reduce the overall payload capacity of the dumper.

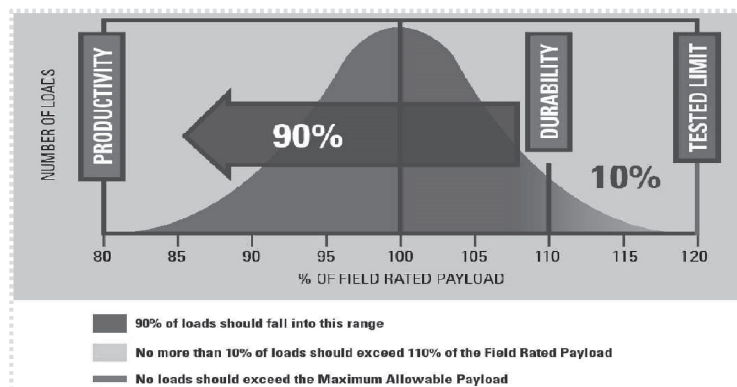
7. Haul road: Haul Road condition refers to the surface condition of the road used for transporting materials. A poorly maintained or uneven road surface can increase the rolling resistance of the dumper, which can decrease its payload capacity.
8. Road gradient: Road gradient is another factor that can impact the payload capacity of dumpers. A steep road gradient can increase the rolling resistance and reduce the speed at which the dumper can travel, thus reducing its payload capacity.
9. RR: Rolling resistance is the force that opposes the motion of a rolling object, such as a dumper. Higher rolling resistance requires more energy to move the dumper, which can decrease its payload capacity.

Average Payload Trend of Komatsu HD785-7 Dump Trucks :



Komatsu HD 785-7 Loading Policy:

To balance the desire for maximum payload with the importance of optimizing machine and component life, Komatsu uses a 10/10/20 policy - recommending that no more than 10% of loads are over 110 % of target payload and never exceed 120%. The mean of the payloads should not exceed the target payload. To help you ensure you're meeting production goals while adhering to this policy, it's essential that you are accurately measuring payload.



Loading Efficiency:

For an operation to benchmark its operating practices, the following guidelines are suggested:

Good: 80% of the loads within a $\pm 10\%$ range of the Field Rated Payload

Excellent: 90% of the loads with a $\pm 10\%$ range of the Field Rated Payload

Placement of Payload:

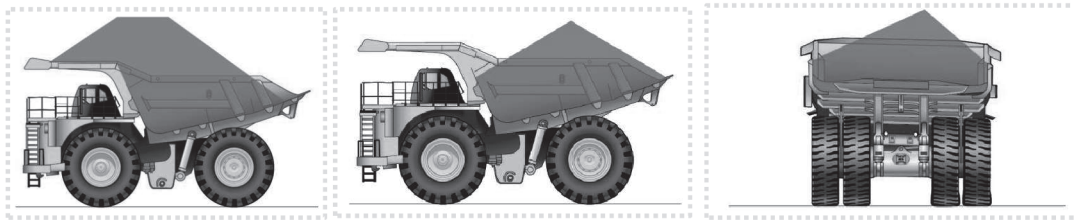
Not only is component life impacted by the amount of payload, but it is also impacted by the placement of the payload. A decrease in component life will occur from improper load placement. Specifically, there are three types of improper load placement, load shifted towards the front, load

shifted towards the rear, and load shifted towards the side. All three types of improper load placement negatively impact frame and body life.

If the load is shifted towards the front, the front brakes, bearings, front tires, steering, hydraulic hoist, body rest pads, and body canopy will be negatively impacted. Trucks with correct load placement and incorrect load placement with the load shifted towards the front.

If the load is shifted towards the rear, the final drive and rear tires will be negatively impacted. Furthermore, the payload will become unstable and dribble off the back of the body. Trucks with correct load placement and incorrect load placement with the load shifted towards the rear.

If the load is shifted towards the side, the final drive, bearings, hoist cylinders, and pivot bore areas will be negatively impacted. Trucks with correct load placement and incorrect load placement with the load shifted towards the side.



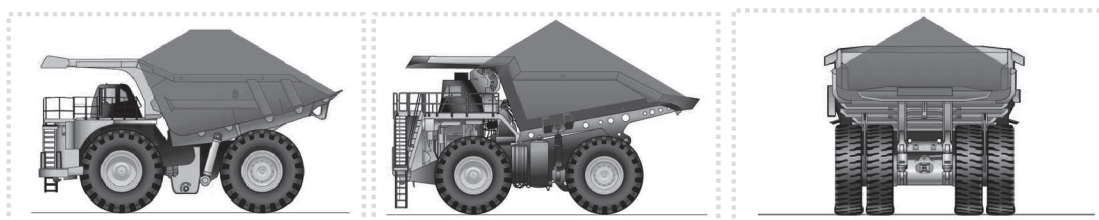
Dumpers Payload Monitoring:

Dumper payload monitoring is a critical aspect of mining operations, and there are several global practices for ensuring safe and efficient operations. Here are some of the most common practices:

1. **Load Monitoring Systems:** Load monitoring systems are widely used to measure the weight of the dumper payload accurately. These systems consist of load cells mounted on the dumper truck and provide real-time information to the operator about the weight of the payload. This helps the operator to avoid overloading, which can lead to accidents.
2. **Payload Management Systems:** Payload management systems are advanced systems that provide more than just weight measurements. They can measure and report payload volumes, densities, and other metrics that help operators optimize their loads and increase efficiency. These systems are especially useful in large mining operations where hundreds of dumpers are in operation.
3. **Automated Dumper Systems:** Automated dumper systems are becoming increasingly popular, as they offer several advantages over traditional manual systems. These systems use sensors, cameras, and other technologies to automate the loading and unloading process, reducing the risk of accidents, and increasing productivity.
4. **Training and Education:** Training and education are essential for maintaining safe and efficient dumper operations. Workers must receive adequate training on the operation of dumpers, load monitoring systems, and other equipment. They should also be trained in safety procedures and emergency response protocols.

These are just a few of the many global practices for dumper payload monitoring. Ultimately, the key to safe and efficient operations is a comprehensive approach that includes the use of advanced technology, rigorous training, and ongoing maintenance and inspection.

Desired Loading Practices: Few pictorial view of standard loading practices.



Improving Payload Capacity:

Based on the above factors, here are some recommendations to improve the payload capacity of the Komatsu HD785-7 Dumper:

1. **Use Lightweight Materials:** One way to reduce the weight of the dumper is to use lightweight materials such as aluminium or composite materials for the dump body and other parts of the vehicle.
2. **Increase Engine Power:** Upgrading the engine power of the dumper can significantly improve its payload capacity. A more powerful engine can carry heavier loads and traverse steeper inclines with ease.
3. **Upgrade Suspension System:** A robust suspension system can handle heavier loads over rough terrain. Installing high-performance shocks and springs will enhance the dumper's payload capacity.
4. **Increase Dump Body Capacity:** Increasing the size of the dump body will increase the amount of material that the dumper can carry. This can be achieved by extending the length or width of the dump body or by increasing its height. Austin trays having larger dimension in comparison to OEM's dump body.
5. **Reduce Tire Pressure:** Lowering the tire pressure can increase the surface area of the tire in contact with the ground. This will improve traction and enable the dumper to carry heavier loads.
6. **Proper Loading:** Operators should ensure that the dumper truck is properly loaded to prevent overloading, which can lead to loss of control and accidents. It's important to follow the manufacturer's guidelines on maximum load capacity and use weighing scales or load cells to accurately measure the weight of the payload.
7. **Communication:** Communication is key to ensuring safety during mine dumper payload operations. Operators should communicate effectively with other workers, including spotters and ground crew, to prevent accidents. They should also use hand signals or two-way radios to communicate with each other during loading and unloading operations.
8. **Use technology:** Advanced technology such as weigh-in-motion (WIM) systems or load cell systems can be used to help operators achieve the optimal payload. These systems can help operators identify the weight of the load and adjust the loading process accordingly.

Conclusion:

Improving the payload capacity of the Komatsu HD785-7 Dumper can significantly enhance its performance and productivity. The above recommendations can be implemented individually or in combination to achieve the desired results. By increasing the payload capacity, the dumper can transport more material in a single trip, reduce the number of trips required, and increase the overall efficiency of mining operations.

Technical Article-2

Determining the impact of Haul Road Design on Fuel Consumption by Using Fleet Management System & Global Mapper software

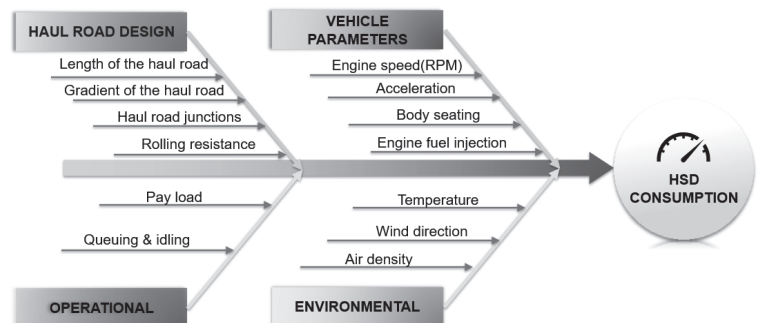
Gorre Srinadh, Assistant Manager
Mining (Khondbond Iron & Mn Mine), M/s Tata Steel Limited

Introduction:

Fuel cost is responsible for a majority share of operating cost in a surface mining operation. High Speed Diesel (HSD), which is costly and has a very significant environmental impact, is used as a fuel for haul trucks in surface mines. Reducing fuel consumption not only leads to reduction in operating costs but also carbon emissions. Haul roads can change rapidly as mining progresses and access to different areas is required therefore designing of haul roads is very important. Khondbond iron mine is an 8MTPA capacity iron mine equipped with 10 dumpers (Komatsu HD-785-7), 4 shovels, 2 loaders, 4 drills 5 dozers, 2 water sprinklers, and a grader. Fuel consumption of dumper itself contributes 51% of total fleet consumption with hourly consumption of 40 Lt. Continuous haul road maintenance is in practice with dozing, grading and compacting by using compactor.

Factors Effecting Fuel Consumption:

There are various factors that effect the fuel consumption of haul trucks in mining operations, some of them can be controllable such as haul road design and operational factors while some may be uncontrollable like environmental factors. Operator's skill also plays an important role which can be improved by proper training.



As this paper mainly deals with haul road design, the Fleet management system (FMS) data such as GPS tracking of haul trucks and Vehicle Health Monitoring System (VHMS) data were integrated to know the various locations of the haul road at which the VHMS parameters are observed abnormal.

Fleet Management System (FMS):

A Fleet Management System (FMS) for mine site is a suite of specialized software running on ruggedized hardware. Using GPS and a wireless radio network, the FMS tracks and monitors production, maintenance, and safety in the mines. The use of Fleet Management System in the mining industry is rapidly increasing is because of its various applications such as production optimization, safety, fuel management, vehicle health monitoring etc.

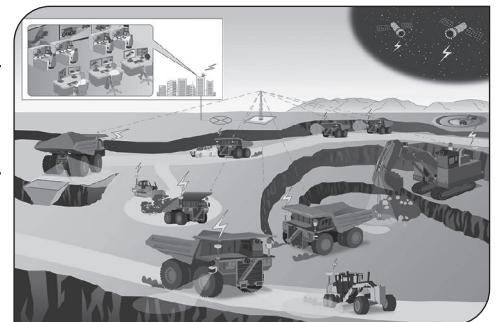


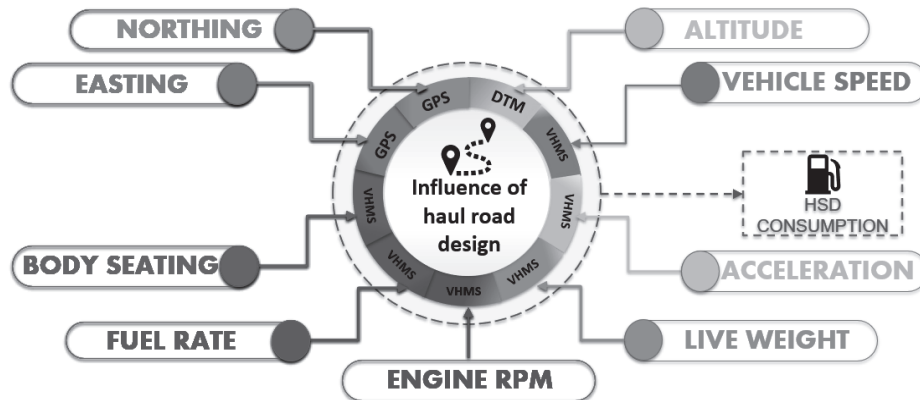
Fig: Fleet Management System

This requires a Mobile Data Terminal (MDT) system installed at mine fleet, which receives signal through a wireless network and transfers the data to the control centre. The equipment can also be continuously tracked through GPS.

Vehicle Health Monitoring System:

A Vehicle Health Tracking System (VHMS) is a technology that tracks the overall performance and condition of a vehicle in real-time, generating reports of key vehicle health parameters. The system uses sensors & other data collection devices to collect and analyse data on various aspects of the vehicle, such as its engine, transmission, brakes, and tires. The data collected by the system can be then processed and analysed to identify any potential issues with the vehicle, such as low tire pressure, engine abnormalities, or transmission problems.

Various parameters considered to determine the influence of haul road design on fuel consumption:



- Northing, Easting are the GPS track points of the haul truck monitored through FMS and are recorded at every 3-5sec intervals.
- Vehicle health parameters such as engine RPM, acceleration, fuel rate (Ltr/Hour), body seating, payload and vehicle speed are also monitored through FMS and are recorded at every 30sec intervals.
- Altitude of the GPS track points to determine the gradient along haul road is obtained by DIGITAL TERRAIN MODEL (DTM) using drone surveying.

Integration of Global Positioning System (GPS) and Vehicle Health Monitoring System (VHMS) data:

As the GPS and VHMS data are recorded at different intervals, it is required to integrate the VHMS data with GPS data with the same time stamp. Some of the sample points are given in the below table.

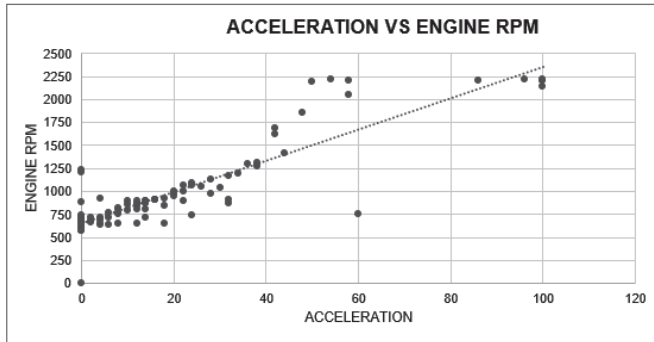
S.NO	Northing	Easting	Timestamp	Equipment Code	Accelerator pedal position	Body seating	Engine speed (RPM)	Live weight	Vehicle speed	Brake position	Fuel rate(L/H)
1	2427254.441	333233.1301	19-05-2023 16:01:48	O2K029	6	0	730	112	0	0	57
2	2427498.461	333139.4055	19-05-2023 16:03:37	O2K029	58	1	1679	1	29	0	149
3	2427530.767	333148.9744	19-05-2023 16:03:44	O2K029	48	1	1569	1	26	0	96
4	2427760.775	333181.8383	19-05-2023 16:04:14	O2K029	44	1	1637	0	28	0	80
5	2427987.125	333274.5594	19-05-2023 16:04:44	O2K029	66	1	1486	1	25	0	228
6	2428173.208	333458.3762	19-05-2023 16:05:18	O2K029	58	1	1725	2	29	0	144
7	2428325.801	333513.7483	19-05-2023 16:05:44	O2K029	66	1	1325	1	23	0	249
8	2428515.932	333470.8324	19-05-2023 16:06:15	O2K029	28	1	1529	1	18	0	0
9	2428595.726	333555.5308	19-05-2023 16:06:44	O2K029	34	1	1274	0	16	0	105
10	2428593.446	333621.4264	19-05-2023 16:09:45	O2K029	32	1	1272	1	7	0	61
11	2428581.391	333646.3832	19-05-2023 16:13:45	O2K029	0	1	657	0	0	0	38
12	2428546.562	333645.0529	19-05-2023 16:15:45	O2K029	26	1	968	1	3	0	98
13	2428569.441	333631.4863	19-05-2023 16:20:45	O2K029	46	1	1529	95	11	0	93
14	2428540.568	333500.7892	19-05-2023 16:21:15	O2K029	30	1	1534	97	19	0	0

This is very important as to exactly map the vehicle parameters along with the GPS track points.

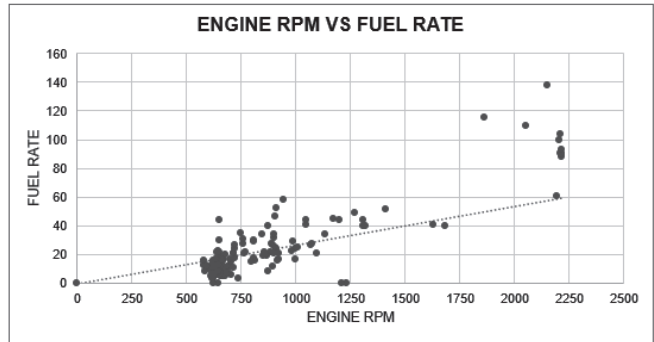
Plotting of integrated data by using Global Mapper software:

The integrated data is imported to the global mapper software along with the Digital Terrain Model (DTM) and Orthomosaic image of the mine. Hence, we will get to know how the vehicle parameters are impacted along the haul road.

- As per the Original Equipment Manufacturer (OEM) test data ideal engine RPM of KOMATSU HD-785-7 for optimal fuel consumption is 1500. The comparison between acceleration, engine RPM, and fuel rate was shown in the below graph.

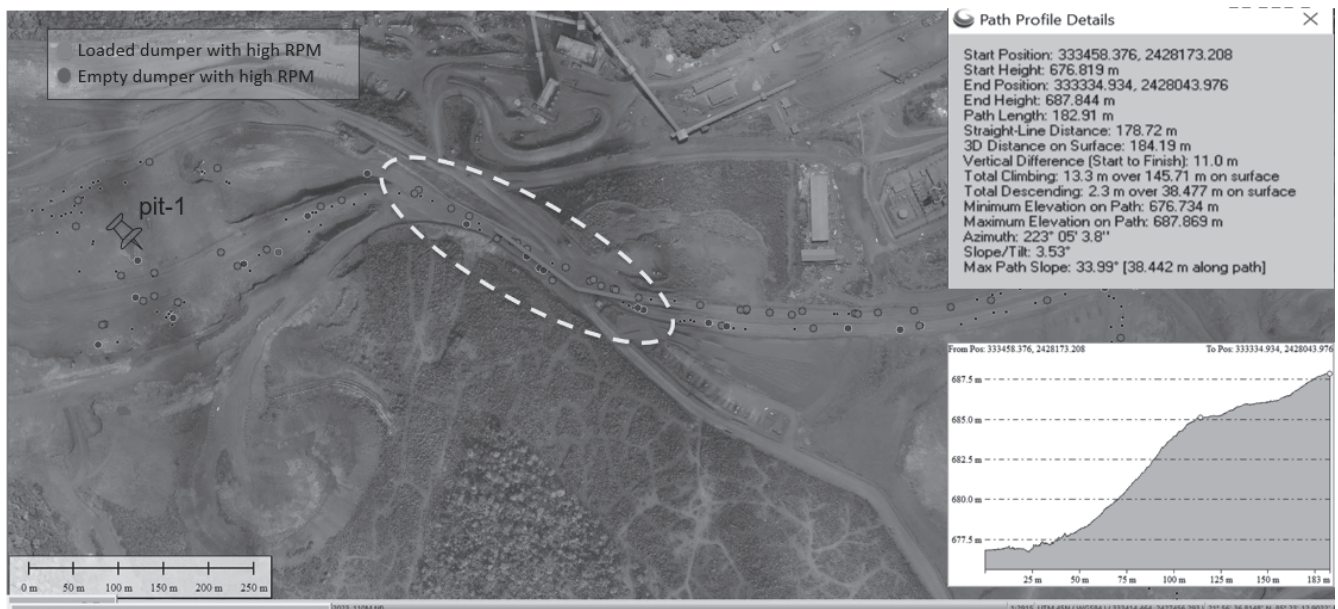


ACCELERATION ↑ ENGINE RPM ↑



Engine RPM ↑ FUEL RATE ↑

- If it exceeds that ideal RPM, it can be considered as an abnormal sample point. This type of abnormal points is observed during both loaded and unloaded condition. If such points are observed frequently at a particular section or part haul road. Then it is required to analyse the design parameters of haul road.



Result:

By this process some sections of the haul road are identified as that are adversely affecting the parameters that results in fuel consumptions. Such sections are redesigned by considering gradient, width and junctions at some parts to obtain the optimum vehicle parameters to limit the fuel consumption.

Way forward:

Rather than manual integration of GPS and VHMS parameters as it requires human intervention and time consuming, it can be done during the report generation itself at Fleet Management System (FMS) so that regular analysis can be done with less time and also with minimal human intervention.

Technical Article-3

Best Practices in improvement of tyre life

Krishna Mohan (Head), Pradeep Kumar Singh (Area Manager) &
Subrata Kumar (Asst Manager), Equipment Maintenance

Background :

Tyre support the load of the vehicle by retaining the inflation pressure. Provide traction, braking and control the direction of travel. Tyre is the third important cost element after Diesel and Explosives in any open cast mines. The life of tyre is primarily affected by Tyre management practices, Haul Road condition and operational practices, i.e. Loading pattern, driving pattern, Tyre condition etc.

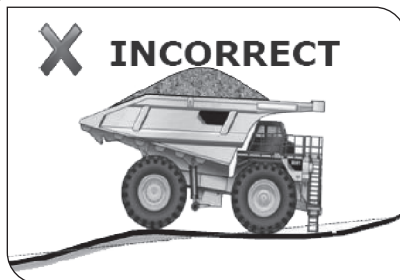
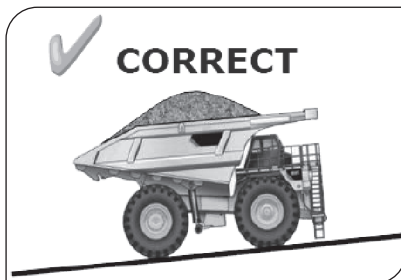
Tyre management includes:

Tyre selection, Tyre storage, inflation medium, Tyre pressure monitoring, Tyre dismantling and assembling procedure, Tyre matching, Tyre rotation etc. Here we will do comparative study of tyre management practices in Joda East Iron Mine to identify scope for improvement and horizontal deployment of best practices.

Major Reasons for Tyre Failure:

1. Poor haul road condition
2. Improper loading face
3. Uneven Load
4. Overload
5. Stone trapping
6. Tyre mismatch

1. Haul Road condition:
Gradient of haul road is a key factor.



2. Loading face should be free of undulations, spillage and boulders



3. Uneven Load



4. Overload



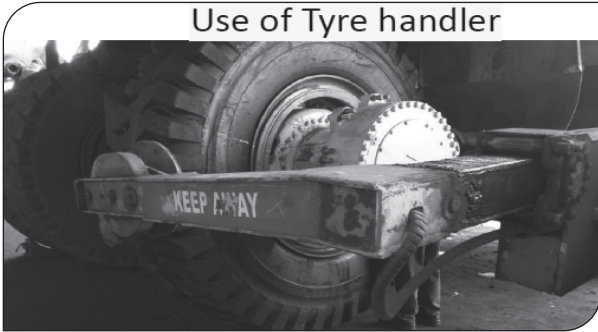
5. Stone trapping: Stone trapping will penetrate up to tyre casing when tyre in running condition, caused tyre failure



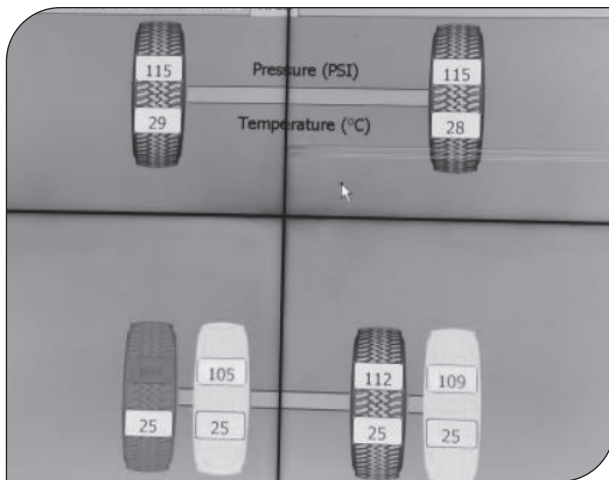
6. Tyre mismatch: It is recommended that tyres fitted on same axle have same RTD and pattern.

BEST PRACTICES IN TYRE MANAGEMENT

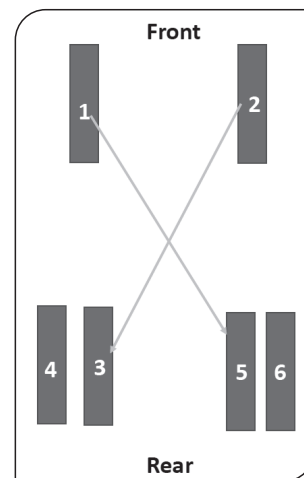
Use of Tyre handler



Tyre Pressure Monitoring System



Tyre Rotation



- New tyres fitted in front are being rotated to rear inner side after RDT (remaining tread depth) is in range 40 45 mm.
- Tyres in rear are being used till RTD is 20 25 mm after that tyres removed and send for re-treading purpose
- Re Tread tyres are being used at rear side only.

Highest Tyre Life achieved at Joda East Iron Mine



- Tyre Make Bridgestone
- Tyre Size 27 00 R 49
- Tyre No S 7 M 004120
- Application
- Komatsu HD 785 Dumper
- Total Life 17205 Hrs

Technical Article-3

Digitization in Mining industry

Alok Kumar Pradhan (Asst. Manager-Instrumentation)
M/s IMFA



How miners can deliver sustained outcomes from their transformation journeys

India aspires to be a US\$ 5 trillion economy by 2024 & US\$ 10 trillion by 2030. It is imperative that mining sector will have a significant play in this growth journey. However, the mining sector contribution to India's GDP has been on the decline. It contributed 3.4% of India's GDP in 1992-93. In recent times, the sector contributes around 3% to India's GDP.

Mining companies are facing multiple challenges related to declining ore quality, volatile commodity prices, political / social activism in mining zones, increased cost of mining among many others. Cost of mining has increased due to higher mine acquisition cost through auctions, delayed statutory clearances, longer implementation timelines, higher taxes, and duties etc.

We're already seeing many miners investing in Industry 4.0 capabilities and automation solutions to respond to these trends. Artificial intelligence and the Internet of Things are informing new solutions, such as predictive maintenance, integrated planning simulations and optimization, digital twins, and robotics for agile operations, which let miners scale production up or down as commodity prices fluctuate.

A critical part of this journey will be improving coordination and collaboration across the organization and developing, enhancing, or refining a data strategy to generate the insights you need to improve your operations.

Here are a few areas where mining companies can start:

A. Take a closer look at current data assets.

Miners are generating more data through their equipment and software platforms than ever before. Before making large investments in new technologies that will create even more information, it's helpful to pause and look for opportunities to use what you already possess to make better—and more timely—decisions. Some examples include:

- ✓ **Data analytics:** There are limits to the amount of analysis individual employees can perform as the volume of data you're generating multiplies. Automated tools can produce meaningful insights that can help create more value from mining operations.
- ✓ **Cloud storage:** Centralized storage makes data more accessible to both operational and business leaders than housing it in different on-premises locations.
- ✓ **Data convergence:** Historically, the numerous software platforms that help run various parts of a mining operation rarely connected with each other. But that's changing. New enterprise resource planning (ERP) systems and operational platforms integrate multiple sources of information from across an organization, tying disparate data sources together to tell a compelling story.

B. Embrace quick wins :

Some mining companies may perceive all digital transformation initiatives as cumbersome and expensive undertakings. But there are often low-cost solutions that drive improvements to key performance indicators such as profitability, health and safety metrics, cost per tonne of production and ESG targets.

For example, we've seen companies use existing technology to create a simple reporting dashboard showing a miner's performance for the previous day. By getting key information, such as tonnes lost the day before, to operators, it's possible to generate meaningful productivity improvements.

These incremental steps that deliver quick wins can add up to bigger improvements over time for

smaller mining companies and larger enterprises alike. And miners can often scale them to fit their size and needs as they grow.

How to move beyond digital:

Digitization is a top priority for many mining executives. While these digital investments are critical for many miners to achieve their organic growth, operational efficiency and ESG targets, winning in today's world requires more than digitization. Increasingly, miners must build unique capabilities that help them deliver value in a unique way. And this requires embracing a holistic journey that considers all elements of transformation.

Must Include:

Strategy: Start by reconsidering your strategy and what drives value for the business. Without this step, you may end up making changes before you've decided on what you're looking to achieve.

Reorganizing for growth: Automate low-value tasks where possible.

Building digital trust: Adopting new technology solutions is opening new opportunities for miners to explore and use data.

Cross-functional alignment: While technology can deliver significant benefits, it can't fix a broken process. To truly make a difference, it's important to develop a clear, cross-functional agenda for achieving your goals based on conscious choices for streamlining processes across the organization.

Creating the mining workforce of the future: We believe a critical element of success lies in combining human ingenuity with technological innovation.



Embracing new opportunities to shape the future:

By following this path, miners can focus their efforts on changes that will help them thrive in the long term. This can also help miners shift resources and costs away from areas that are no longer a priority, which they can then reallocate to their investment priorities.



Technical Article-4

Drone for Mining industry

Alok Kumar Pradhan (Asst. Manager-Instrumentation)
M/s IMFA

Mining processes are highly labour-intensive which require huge investment to check the safety of laborers. Mining industries are searching for new technologies to reduce costs and enhance productivity and worker safety. Drones are one of such technologies that can be applied across mine sites, making on-site activities a lot safer and more productive. Drones in mining boost the overall productivity of large mine sites and quarry management by giving exact and



comprehensive details of data in a very short time. This data can be safely produced by on-site laborers who have little surveying experience at a fraction of the cost of traditional survey methods. Across the mining industry, drones are exhibiting surprising results by allowing much greater data collection, improving safety, and intensifying productivity. The popularity of drone technology across the mining industry has increased significantly in recent years. In mining, drones have various applications like mine surveying, inventory management, stockpile evaluation, and hot spot identification, etc.

The top companies in the world have already started to integrate drones for mining. In fact drones have proven to be vital tools across every part and phase of a mine site from exploration, to drilling and blasting, to reclamation.

How are drones used in mining to boost operations?

Every mine presents its own unique challenges. Chances are good that they are based on one of the following key jobs that drone mapping makes easier across the life cycle of a mine site:

1. Hazard identification

Correcting potentially- dangerous site features and avoiding safety hazards is easier when you have more frequent and more accurate surveys of all the active areas of your mine. This has been well known and researched since earlier days of the technology.

2. Haul roads

Measure, monitor and update haul roads with accurate data from mining drones.

3. Underground

Specially-designed mining drones are collision tolerant and equipped with lights and real-time controls for quick inspections of underground environments that cut costs and boost safety.

4. Water and sediment flow monitoring

It's easier to manage your site and prevent setbacks and hazards related to uncontrolled water movement with more

frequent aerial surveys based on a more accurate comparison of terrain and water levels. Mine sites also need tight water treatment and management plans to begin aligning to the technological age of industry.

5. Drilling and blasting

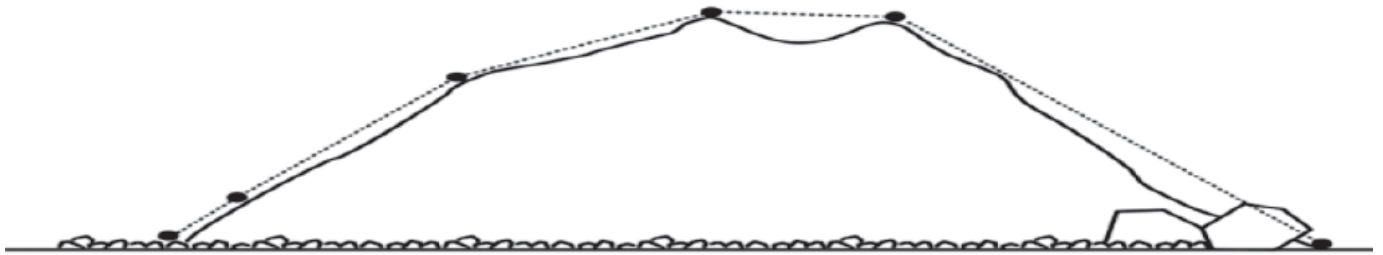
Get precise and detailed aerial views of drill patterns and blasting results.

6. Stockpile management

With drones, measuring volumes is based on hundreds of times more data points and is 100 percent safe since data can be captured from a distance vs. climbing on slopes.

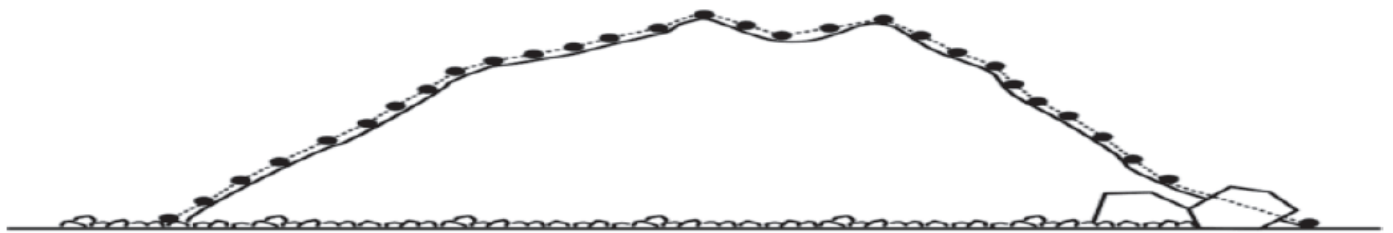


Traditional GNSS survey



Only a few data points can be collected, craters and steep slopes are often overlooked.

Drone survey



Hundreds of data points are collected, including steep slopes or craters sometimes invisible from the ground.

7. Maintaining tailings dams and ponds

Prevent unexpected activity and leaks with clearer, more frequent drone survey data. Additionally, more sophisticated analytics are available to prevent breaks when using data-rich drone imagery.

8. Reclamation

Returning land to its original state is much more feasible if you have data that allows you to see how the land has changed and what needs to be done to return it to the original state.

9. Reporting and auditing

Tracking and recording what happens onsite is much easier with a history of accurate aerial or underground imagery providing exact figures to present or compare with contractors.

10. Drones for mineral exploration

Aerial data from drones helps produce base geology maps for planning and excavation of assets.

Technical Article-5

ZERO ENTRY MINING IN SURFACE MINING OPERATIONS

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ABSTRACT

Zero entry mining operations are designed so that no-one need ever enter a mining zone. There is a strong business case to apply zero-entry mining in large surface mines that are exploiting ore bodies which are open at depth, or are mining zones subject to considerable risk. This study seeks to identify the gaps in current automation capability in order to achieve and to sustain zero-entry mining operations as applied to surface mines. The study also concludes that there is a need to develop an automated (or remote controlled) multi-functional platform capable of performing a wide variety of tasks, from geological grab sampling or as a mobile sensor platform along with assisting in moving lighting and communication infrastructure, electrical transformers and cables etc.

1. INTRODUCTION

In the last decade, mining and associated companies have made great progress regarding the introduction of autonomous haulage and blasthole drills in large bulk-mining surface operations. However, there are a number of mining operations around the world where geotechnical or geothermal hazards greatly restrict mining operations. An ideal solution would be the ability to extract material from these zones without anybody ever having to enter the hazardous zones. This



is known as “zero-entry mining”. Zero Entry Mining not only reduces risk exposure to personnel, but can also be a significant source of added economic value through higher utilization of equipment, reduced services (e.g. ventilation) and increased revenue through access to difficult to mine areas. for example, involve exploitation of ore at depth with steep pit walls, or mining underneath unsupported ground 2 which may involve unacceptable risk for personnel to enter the mining zone. Ultimately zero entry mining will enable the complete re-design of mines, mining equipment and mining methods in ways that were not possible if personnel were in the mining zone”.

Large metalliferous surface mine with ore deposit open at depth

In particular there is a strong business case to apply zero-entry mining in large surface mines that are exploiting oroboides which are open at depth (see Figure). In such mines, conventional extraction with large capacity equipment would proceed until the ultimate pit limit is attained. Then, using a zero-entry mining approach, smaller capacity autonomous systems could be used in conjunction with steeper inter-ramp angles near the base of the pit in order to scavenge remaining reserves There are many processes in conventional mining operations that require human intervention. Despite the great strides that have been made in mining automation, many gaps exist to achieve the ultimate goal of zero-entry mining in surface operations.

2. Objective

In Australia and elsewhere have changed the perception of risk in some parts of the mining industry, as well as accelerating the pace of adoption of digital technologies by the industry. This paper discusses these changes as well as progress towards resolving the previously identified challenges to zero-entry mining.

3. CURRENT AUTONOMOUS CAPABILITY

As applied to surface mining, autonomous capabilities are currently limited to blasthole drills and truck haulage. A number of companies have developed autonomous capability for blasthole drills, including Epiroc, Sandvik and Caterpillar. However, whilst rotary, pulldown and propel and navigation functions have been automated, some gaps exist even within the capabilities of commercially available drill rigs. One such gap is the ability to discriminate top-of-coal in overburden and interburden applications. Australia currently has some 220 autonomous haulage trucks (AHTs) in

operation, the largest fleet in the world. The principal suppliers of AHTs are Komatsu, Caterpillar and Hitachi. Interestingly, at the recent CIM conference in Toronto, Hitachi Mining and Construction announced that they intended to open their operating system to other vendors to facilitate greater interoperability between equipment from different vendors. Sandvik (Mining Monthly March 2019) has also committed to opening up its underground automation to other manufacturers through an API. One of the difficulties encountered with AHTs concerns loss of satellite signal. The Global Positioning System (GPS) works if four satellites are visible. Due to the extreme geography (mountains etc.) or very deep pits, it is possible for trucks to move into a satellite shadow. One solution to this is to employ positioning systems that can work with both GPS and GNSS, the Russian positioning system. Another solution is to employ a number of pseudosatellites which provide an artificial satellite signal to supplement those satellites in shadow. Zero-entry mining activities at the base of a deep pit may have to consider the additional expense of investing in a number of pseudo satellites to supplement GPS and GNSS

4.1 Surveying - Pre-dig preparation

In many conventional surface mines a surveyor is responsible for establishing dig limits on mining benches as well as delineating grade and contaminant zones. Typically this requires that the surveyor use stakes with different coloured tape. Modern GPS dig control systems installed onboard diggers can replace the need to stake out ground. Dig zones can be updated and downloaded via the mine intranet system to the diggers. The Argus™ shovel monitor from Komatsu Mineware is one such system (see xx). Thus technological solutions exist to assist pre-dig surveying, however some mines will need to invest in such systems if they desire to move towards zero-entry mining. Ultimately remote sensing 5 and augmented reality providing remote operators or automated systems with accurate geological or grade boundaries whilst operating will be needed.

4.2 Surveying - Surveying - Post-dig reconciliation

As benches are extracted it is necessary to reconcile extracted tonnes with the short term mine plan. This is done in order to control costs and to adjust for any deviation from plan. Some work has been undertaken on LIDAR scanning systems fitted to shovels in order to provide reconciliation (see Williams & McAree, 2008). However, the resultant maps are used to update the situational awareness of the shovel, and have not been fed back to update the mine plan; this provides an interesting possibility going forwards. The other alternative is the use of drones to fly over dump and excavation zones in order to reconcile material movements. Drones are now regularly flown in some large coal operations. There is no technical impediment as to why they cannot be applied to zero entry operations in surface mines. Applications such as Glass-Terra's Live Terrain take survey inputs from multiple inputs such as equipment and stationary LIDAR, drones, as well as manual survey reading to maintain a single Digital Terrain Model (DTM) that is then made available for all applications.

4.3 Geology - Data capture and sampling

In zero entry mines, it will no longer be possible for mine geologists to physically map or to collect chip samples from drills. Instead, a means of automated sampling or sensing whilst drilling or in hole after drilling will be required. This might be achieved with a general purpose mobile robotic platform with an adaptable tool set. Either this could be remote controlled or have some or all functions automated. An early prototype of this approach (as presented at Austmine 2019 Conference) is being developed by CRC Ore in conjunction with Imdex and Orica using a Universal Field Robotics platform as part of their Instrumenting the Bench initiative.

4.4 Engineering - Geotechnical stability assessment

As mining progresses new structural controls may be uncovered that require geotechnical assessment. In zero entry operations, a drone will have to be used to examine walls. However, 3D perception is required in order to assess the strike and dip of structures. Thus the drone will require a dual camera system in order to provide images in stereovision for a geotechnical engineer to interpret.

4.5 Operations - Wall control installation

Should a geotechnical assessment identify a high risk of failure, it may be necessary to install form of wall control in terms of bolts and mesh. This would require development of an automated drilling and bolting unit. Some R&D work has been carried out on autonomous bolting systems for underground applications by CRCMining.

4.6 Operations - Blasting services

Companies such as Orica have developed systems that combine GPS systems onboard explosive trucks with digital blast designs to control the loading of explosives into blastholes. However, priming a blasthole by inserting a detonator into a booster and lowering these into the blasthole is currently still a manual process. Some years ago, some R&D work was undertaken by CRCMining for the Savage River mine in Tasmania to enable remote priming of holes. This was in response to mining in the presence of an unstable hanging wall. More work needs to be undertaken here to enable automated priming. 6 The tie-in process to connect the blast pattern via NONEL tubes and delays is another process requiring dexterous manual hands. This is a case where some out-of-the-box thinking may be possible such as wireless detonation. Currently, a wireless initiation of explosives carries a risk of accidental detonations, particularly in the presence of stray electromagnetic fields. It is postulated that a dual frequency system may provide for greater safety and permit wireless detonation. This, in turn could eliminate the requirement for connection via NONEL tubes.

4.7 Operations - Autonomous digging

A muckpile of broken rock is an extremely unstructured environment for automated digger. Each bucket load taken from the muckpile causes a reorientation of the muckpile. Although much work has been done on automated LHD and front end loading, there is currently no system on the market that will manage unsupervised loading of shovels or hydraulic excavators. In addition to the tactical simultaneous location and mapping (SLAM) capability required to excavate a muckpile, autonomous diggers will also require mission planning algorithms to optimally guide them to extract a full bench.

4.8 Operations - Refuelling Refuelling of AHTs

could be conducted outside of the zero-entry autonomous zone, however this will contribute to a loss of production hours for the trucks. As with most large pit operations, it may be expeditious to adopt an in-pit refuelling strategy. This will require an autonomous refuelling strategy. Again, this gives rise to an opportunity to rethink refuelling; might it be more expeditious, for example to change out an entire fuel tank rather than trying to locate and connect fuel hoses automatically?

4.9 Operations - Interoperability

A barrier to the uptake and interoperability of autonomous mining equipment in the mining industry is the lack of an agreed set of standards across the industry. OEMs employ different bus structures and there is little agreement on standard communication protocols. Toward this aim, the Global Mining Guidelines (GMG) group has established a number of working parties. GMG was first established by the oil sands operations in Alberta, Canada, but has grown in scope to encompass representatives of many of the major mining houses and OEMs. A supplement – and perhaps an alternative - to the development of interoperability standards is the concept of developing an “air traffic control” system for surface mining operations. Under such a system, the near surface land and airspace would be divided into different zones, with permission for machines to enter zones strictly policed by supervisory control software. Such a project has been put forward as part of a new Cooperative Research Centre bid around the introduction of Industry 4.0 concepts into mining.

4.10 Operations - Road and bench maintenance

To optimise AHT and digger performance and life expectancy there is a need to maintain haul routes and bench surfaces in good operational state. In a zero entry mine, this will require automated motor graders and wheel dozers. Whilst GPS is routinely used to enable “grade to design” on motor graders, it has not been used for direction and steering control. Thus, there is some development work necessary here. Opportunity exists to use 7 the sensor data from AHT (e.g. Strut pressures and

LIDAR) to identify areas requiring road maintenance and spillage.

4.11 Maintenance - GET replacement

As with lubrication and filter replacement, it may be necessary to replace wear parts such ground engaging tools (for example, dipper teeth and adapters) in the field. This, of course, assumes that rapid change out buckets cannot be employed, as such buckets can be returned to a central workshop for repair and reconditioning. Again, a new generation of dipper and bucket lips may need to be designed to suit autonomous change-out of ground engaging tools from first principles.

4.12 Mining services - Recovery systems

The reliability of equipment operating in zero-entry mines can be likened to mission critical applications, such as twin-engine extended range operations for airliners. This demands revised thinking on how to assure operations over a campaign life. However, inevitably some equipment failures will occur in-pit. It will then be necessary to recover the failed equipment. For a start, this is only feasible if equipment is size suitable to recover. Thus, large and/or ultra capacity equipment may be ruled out in zero entry operations. A remote controlled recovery rig would be required to tow, or transport, equipment out of the zero-entry zone. Something like an oversized airport tug can be envisaged, or a remote-controlled flat bed.

4.13 Mining services - Pumps, power, lighting

Continuous provision of services such as lighting, power and pit dewatering are a routine consideration of any mining operation. With regards to electrically powered equipment, there is a need to move transformer stations, relocate cable bridges, move cables, all of which may best be performed in a zero-entry mine under remote control. Although it may seem strange to maintain lights in a fully autonomous mine, a lighting station can double as camera pod and/or a communications station to enable supervision of mining operations at night and in periods of low visibility. There is a need to develop a remotely controlled multi-purpose services vehicle to enable these tasks. Such a vehicle could be extended to cover basic service inspection and maintenance tasks. Some work has been done in remotely controlled service vehicles for underground mines by Inco in Canada (Now Vale) and CSIRO in Australia.

CONCLUSIONS

There is a strong business case to apply zero-entry mining in large surface mines that are exploiting oroboides which are open at depth or are mining zones subject to considerable geotechnical or geothermal risk. This study seeks to identify the gaps in current automation capability in order to achieve and to sustain zero-entry mining operations as applied to surface mines. The study identified a list of fourteen initiatives associated with mine geology, surveying and engineering, operations, maintenance and mine services. By considering the applicability of these automation initiatives to current surface mining operations, a suggested development time frame is suggested for developing solutions to these gaps. It is interesting to note that operations initiatives (such as interoperability) take priority, as these have an immediate applicability in current surface mining operations. The exception to this is Ground Engagement Tools (GET) replacement robotization where there is a clear OH&S benefit. Surveying, Engineering and Mine service initiatives have lower development priority. There is a clear warning here for the mining industry not to neglect the development of these applications. The study also concludes that there is a need to develop an automated (or remote controlled) multi-functional platform capable of performing a wide variety of tasks, from geological grab sampling to assisting in moving lighting and communication platforms, electrical transformers and cables.

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Technical Article-6

The Important of Sustainability in Electrical Industry

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Sustainability is about doing better in a continual approach.

When we incorporate the most effective social, environmental, technical initiatives in our day-to-day approach, it opens roads to new opportunities to save the planet not only by making it more green, resources conservation, efficient energy utilization & conservation etc. but also, in many many more ways.

It's a journey, and every small step counts towards creating a better future for generations to come. Sustainability is vital in the electrical industry, where environmental impact and energy efficiency are key concerns.

This includes.

- Sustainable practices,
- Promoting energy efficiency,
- Integrating renewable energy,
- Adopting a life cycle approach, etc.

The electrical industry is undergoing a transformative shift towards sustainability, recognizing the crucial role it plays in shaping a greener future. As concerns about climate change and resource depletion intensify, embracing sustainable practices in the electrical industry has become more important than ever. There is significant impact of sustainability in the electrical industry for a more environmentally conscious and efficient future.

Environmental Conservation:

Sustainability in the electrical industry revolves around minimizing its environmental impact. By adopting sustainable manufacturing processes, optimizing energy usage, and reducing carbon emissions, it can contribute to preserving our planet's resources. Embracing sustainable practices not only safeguards the environment but also enhances the industry's reputation as a responsible and eco-friendly sector.

Energy Efficiency:

Energy efficiency is a key pillar of sustainability in the electrical industry. As energy demand continues to rise, it becomes crucial to optimize energy consumption.

The uses of energy-efficient electrical equipment, such as motors, transformers, and switchboards, to significantly reduce energy waste and greenhouse gas emissions. The energy-efficient solutions not only benefit the environment but also lead to substantial cost savings for consumers and businesses alike.

Renewable Energy Integration:

It is the renewable energy revolution in the electrical industry. By embracing and promoting the integration of renewable energy sources, such as solar and wind power, we accelerate the transition away from fossil fuels. This integration not only reduces dependence on finite resources but also contributes to a cleaner energy mix. The research and development initiatives require to further solidify to sustainability in this regard.

Smart Grids and Energy Management:

Advancements in technology have paved the way for smarter electrical grids and energy management systems. The smart grid solutions provide enhance energy efficiency, reduce power losses, and facilitate the integration of renewable energy sources.

Lifecycle Approach:

Sustainability in the electrical industry extends beyond manufacturing. Lifecycle approach has to be adopted by considering the environmental impact of products throughout their entire lifespan, from

production to disposal.

It must be emphasized responsible usage, maintenance, repair, and recycling of electrical equipment to reduce waste and minimize environmental harm.

Sustainability in Electrical System

Sustainability is not a choice but a necessity for the electrical industry. By prioritizing sustainability, companies have the power to make a significant impact. Embracing sustainable practices enables them to contribute to environmental conservation, drive energy efficiency, integrate renewable energy, adopt a lifecycle approach etc.

Not only does this benefit the environment, but it also enhances the industry's competitiveness, reputation, and resilience. The power of sustainability in the electrical industry lies in its ability to shape a cleaner, more efficient, and sustainable future for generations to come.

On this journey, every small step counts towards creating a better world for us and future generations.

The Energy audit is also a key tool, to find out means of energy saving.

We must focus on sustainability efforts and we must continue to push forward to promote the advantages of more intelligent electrical systems, as they have the potential to significantly reduce energy consumption and cost through data collection that ultimately benefits the system and the environment.

Some of the tools we may go for

- Uses of Energy efficient equipment.
- Conducting Energy Audit.
- Implementation of latest knowhow system approach to study the consumption Pattern.
- Administrative controls.
- Awareness development within the inmates.
- Maintaining the data
- Analysing the data in line with continual improvement.
- Maintaining that achieved level with an intention of achieving the next level.
- Ensuring the economical feasibility along with its pay back period.
- More use of Automated systems. etc.

Digitisation

When it comes to saving on cost and energy, data is key.

The next generation of products will be focused on leveraging automation and artificial intelligence to learn about a system's total energy pattern.

The most important points to gather the data on consumption, as these will help to ascertain energy consumption on equipment wise, building wise etc., enabling to plan further.

Installing intelligent, connected, data-rich networks that can identify patterns and adjust accordingly are ultimately our greatest asset when it comes to saving time, energy, and the planet.

Commitment. All corporates should have a sustainable approach with a commitment taking various related factors into account like

Resource conservation: Preserving valuable resources through responsible and efficient management.

Energy efficiency: Optimizing energy use to minimize waste and environmental impact.

Habitat Protection: Safeguarding ecosystems and natural habitats for biodiversity and balance

Local community enrichment: Empowering and enhancing the well-being of communities in our operational areas.

Approach

Nothing can be achieved within a night. We must put our effort to achieve the steps of sustainability. Achieving a step-in sustainability may be tough but to maintain that level of sustainability eyeing the next level is more tough.

Hence the sustainability system must be a process approach instead of person approach.

Technical Article-7

Maintenance Functions

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WHAT IS MAINTENANCE?

- ❖ It guarantees all production-related machinery & equipment.
- ❖ It makes provisions for consumables & replacement parts for maintenance.
- ❖ In the industrial sector like function tests, maintaining, repairing, or replacing relevant devices, equipment & machinery processed.

OBJECTIVES OF MAINTENANCE:

- ❖ Reducing breakdowns & emergency shutdown.
- ❖ Optimising resource utilization
- ❖ Reducing down time
- ❖ Improving spare stock control
- ❖ Improving equipment efficiency
- ❖ Reducing scrap rate
- ❖ Optimising the useful life of the equipment.
- ❖ Providing reliable cost & budgetary control

TYPES OF MAINTENANCE:

- ❖ Breakdown Maintenance
- ❖ Preventive Maintenance
- ❖ Autonomous maintenance

BREAKDOWN MAINTENANCE:

- ❖ Done after the machine breakdown.
- ❖ Operator informs to his team leader/Supervisor to raise a complaint to the maintenance team
- ❖ The team rushes to the machine & fixes the issue.

Sl.No.	Advantages	Disadvantages
1	Start-up cost low	Unpredictability
2	Lower maintenance expenses	Equipment not maximized
3	Higher potential margins	Indirect costs

PREVENTIVE MAINTENANCE:

- ❖ Done by maintenance team at regular intervals to keep the machine in working condition.
- ❖ Maintenance team would do scheduled based maintenance.
- ❖ Calendar should be created covering all major machine in the unit & person responsible for the same.

Advantages

1. The approach allows for scheduling modification to accommodate other works.
2. Energy Savings as a result of improving the efficiency of the equipment.
3. Reduced equipment or process failure
4. Overall saving

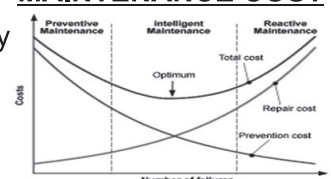
Disadvantages

1. When performing needless maintenance, there is potential harm.
2. Maintenance performed according to a schedule is not needed.
2. Savings are difficult to see without a base line.

AUTONOMOUS MAINTENANCE:

- ❖ It is part of preventive maintenance .Done by the operator by themselves on daily basis.
- ❖ CLITA-Cleaning, Lubrication, Inspection, Tightening, Adjustment
- ❖ Minor spare change can come under AM (Autonomous Maintenance)

MAINTENANCE COST



Technical Article-8

Mechanisation and Maintenance in Mines

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The mining industry has come a long way from the days of excavation through labours manually to highly equipped machineries. Today, mechanisation plays a crucial role in enhancing the productivity and safety of mining operations. The use of heavy machinery and advanced technology has revolutionized the sector, but with great power comes great responsibility. Proper maintenance is the key to ensure that these machines perform optimally and safely. Here, we will explore the significance of mechanisation and maintenance in mines, highlighting the balance between efficiency and safety.

The Rise of Mechanisation in Mining

Mechanisation in mining involves the use of various machines and technologies to extract minerals and ores from the Earth's crust. This shift from manual labour to machines has greatly increased the speed and scale of mining operations, making it more efficient and cost-effective. Some key mechanisation technologies in mining include:

Excavators and Loaders: These heavy machines are used to dig, scoop, and transport materials from the mining site.

Drilling Equipment: Drills and rock breakers are essential for creating blast holes and breaking down rock.

Conveyors and Haul Trucks: These are responsible for moving materials from the extraction site to the processing or storage areas.

Automated Equipment: Advance in robotics and automation have introduced autonomous vehicles, remote-controlled machines, and even drones for surveying and monitoring.

Data Analytics and Sensors: Mines with modern machineries utilize data analytics and sensors to monitor machine health (On board Diagnostic), safety conditions, and predict maintenance needs.

Benefits and Challenges

The mechanisation of mining has brought a large number of advantages:

Efficiency and Productivity: Mechanisation increases mining output and efficiency, meeting the ever-growing demand for resources.

Precision and Consistency: Machines can perform tasks with a high level of precision and consistency, leading to more accurate and uniform results. This is particularly important in tasks like drilling, blasting, and ore sorting.

Faster Operations: Mechanized mining processes are generally faster than manual methods. This speed can lead to quicker extraction, processing, and transportation of minerals, ultimately boosting productivity.

Safety: Automation minimizes risks to human workers, reducing accidents and injuries.

Cost Reduction: Reduced labour costs and improved efficiency contribute to lower operating costs.

Environmental Responsibility: Sustainable practices and technology adoption contribute to a more responsible mining industry.

While mechanization in mining offers numerous benefits, it also comes with several challenges and considerations that need to be addressed to ensure its successful implementation. Here are some of the key challenges associated with mechanization in mining:

High Initial Investment: The capital costs for acquiring and installing modern mining equipment and technology can be substantial. This initial investment can be a barrier, particularly for smaller mining operations or those in financially constrained regions.

Skilled Workforce Requirements: Mechanized mining operations require a skilled and technically competent workforce to operate and maintain the equipment. There may be a shortage of such personnel in some areas, leading to recruitment challenges.

Training and Safety: Mechanized mining demands rigorous training programs to ensure the safe operation of equipment and adherence to safety protocols. Failure to provide adequate training can

result in accidents and injuries.

Environmental Concerns: Some mechanized mining processes can have environmental impacts, such as increased energy consumption, emissions, and disturbances to ecosystems. Addressing these concerns may require additional investments in environmental mitigation measures.

Maintenance and Repairs: While mechanized equipment tends to be more reliable, it still requires regular maintenance and occasional repairs. Downtime for maintenance can affect productivity, and maintenance costs need to be managed.

Equipment Maintenance Knowledge Transfer: Ensuring knowledge transfer from experienced maintenance personnel to new workers is crucial to maintain equipment reliability. The loss of experienced personnel can pose challenges.

Safety Considerations in Machine Maintenance

Safety considerations in machine maintenance in mines are more important than anything else, as mining equipment is often large, complex, and potentially hazardous. Proper maintenance is crucial to ensure the safe and efficient operation of mining machinery. Here are some key safety considerations for machine maintenance in mines,

- 1. Training and Competency:** Ensure that maintenance personnel are properly trained, certified, and have the necessary skills to work with heavy machinery. Ongoing training and competency assessments are crucial to stay up to date with evolving equipment.
- 2. Lockout/Tagout Procedures:** Implement and strictly adhere to lockout/tagout procedures when performing maintenance to prevent accidental startup of equipment. This involves isolating energy sources and using locks and tags to secure them.
- 3. Personal Protective Equipment (PPE):** Mandate the use of appropriate PPE, such as helmets, gloves, goggles, and safety boots, for maintenance personnel to protect them from potential hazards.
- 4. Fall Protection:** In situations where maintenance personnel need to work at heights, provide fall protection systems, including harnesses and guardrails, to prevent accidents.
- 5. Hazardous Materials Handling:** Ensure that maintenance staff are aware of and equipped to handle any hazardous materials they may encounter during maintenance tasks.
- 6. Documentation:** Keep accurate records of maintenance activities, including inspections, repairs, and replacement of parts. This documentation can be useful for identifying trends and ensuring compliance with safety regulations.
- 7. Emergency Response:** Have well-defined emergency response plans in place, including the location of emergency exits, first-aid stations, and communication procedures.
- 8. Safety Inspections:** Conduct regular safety inspections of equipment and machinery to identify potential hazards and address them proactively.

Best Practices for Safe Machine Maintenance

Safe machine maintenance in mines is critical to ensure the well-being of workers and the efficient operation of mining equipment. Here are some best practices for safe machine maintenance in mines,

- 1. Scheduled Maintenance:** Perform routine maintenance tasks according to a regular schedule to prevent equipment breakdowns and failures.
- 2. Equipment Isolation:** Always isolate and lock out machinery before commencing maintenance activities to prevent accidental activation.
- 3. Training and Competency:** Ensure that maintenance personnel are well-trained, competent, and certified to work on specific types of equipment. They should be familiar with safety procedures, potential hazards, and the correct maintenance techniques.
- 4. Risk Assessments:** Conduct thorough risk assessments before maintenance tasks, identifying potential hazards and developing strategies to mitigate them.
- 5. Use the Right Tools:** Ensure that maintenance personnel have access to the appropriate tools and equipment needed for the job. Using the correct tools can prevent accidents and damage to equipment.

- 6. Communication:** Establish clear communication between maintenance personnel, equipment operators, and site supervisors to coordinate maintenance tasks and ensure safety.
- 7. Documentation:** Keep detailed records of maintenance activities, including work permits, checklists, and safety reports, to ensure compliance and accountability.
- 8. Safety Culture:** Always try to encourage a safety-first culture within the mining organization, emphasizing the importance of safety in all operations, including machine maintenance.

Mechanisation has significantly transformed the mining industry, making it more efficient and safer. However, to gather the full benefits of mechanisation, mines must prioritize proper maintenance to ensure that their machinery runs smoothly. By striking a balance between efficiency and safety, the mining industry can continue to evolve and meet the world's growing demand for natural resources while minimizing environmental impact and ensuring the well-being of its workforce.

Safety is non-negotiable in the mining industry, particularly when it comes to machine maintenance. Heavy machinery, hazardous materials, and challenging working conditions necessitate a strong commitment to ensuring the safety of maintenance personnel. By adhering to the best practices and safety considerations outlined in this article, mining operations can mitigate risks, prevent accidents, and maintain a safe working environment, ultimately ensuring the well-being of their workforce and the long-term success of the industry.

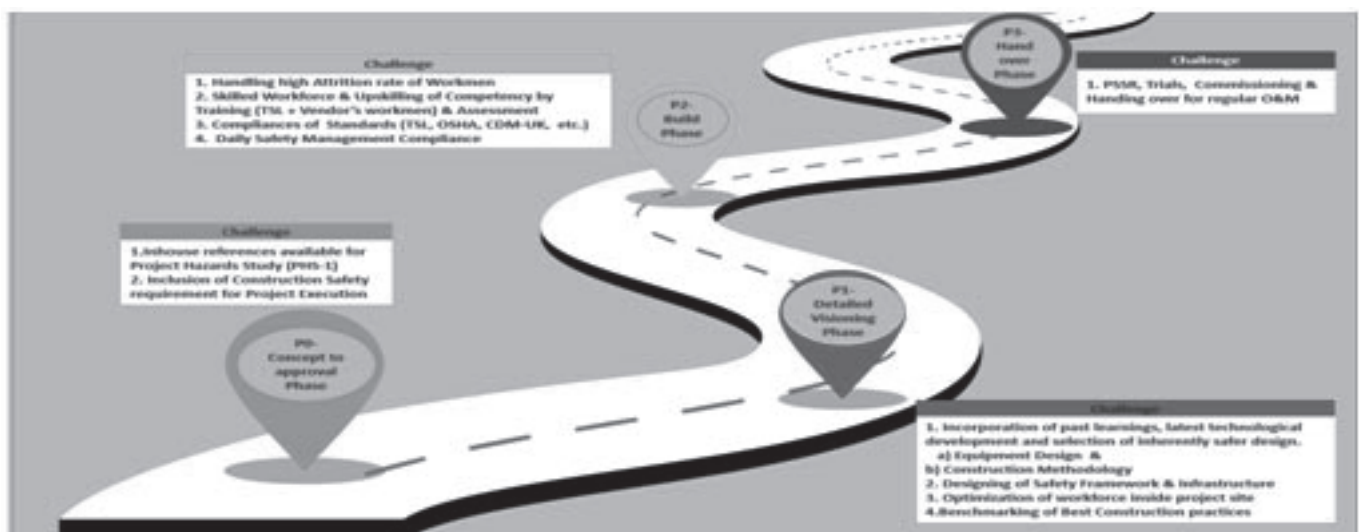
Technical Article-9

Enhancing construction safety at Mine Site: A comprehensive approach

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Construction sites are dynamic environments where safety should be a top priority. With the potential of accidents leading to severe injury or even fatalities, it is crucial to implement a comprehensive approach to construction safety. This article aims to explore various aspects of construction safety, including risk assessment, training & education, equipment usage and the importance of safety culture.

In all phases of project from concept to beneficiation, there are many challenges, and the safety requirements should be embedded in such a way so that it is seamlessly implemented.



Risk assessment: Before initiating any construction project, a thorough risk assessment should be conducted. This involves identifying potential hazards, evaluating the level of risk associated with each hazard, and implementing control measures to minimise or eliminate those risks. Factors such as working at height, electrical hazards, confined spaces, and heavy machinery operations should be carefully assessed and addressed.

Training and awareness: Providing adequate training and awareness to all workers involved in construction projects is essential for maintaining a safe working environment. Workers need to be aware of potential hazards, proper use of PPE (personal protective equipment) and safe work practices. Regular safety training sessions, skill/upskill training and toolbox talks can enhance and promote a safety-driven mindset.

Equipment usage: Proper selection, inspection and maintenance of equipment play a significant role in construction safety. Equipment must be suitable for the task at hand, and the operators should be trained in its operation. Periodic inspection and maintenance checks should be carried out, ensuring that mechanisms such as brakes, alarms, and safety devices are functioning correctly.

Centralised resources: Scaffolding systems, Material handling cranes & equipment etc are a critical aspect of a construction safety. Providing standard & safe resources in time not only improves the safety overall but also helps in optimising the resources. Engaging specialized vendor & resources always minimise the overall risk of new job site, situations in project site.

Safety culture: Instilling a strong safety culture within the construction industry is paramount. A culture that values safety encourages workers to actively participate in safety programs, report hazards, and share ideas for improvement. Regular safety meetings, incident reporting protocols and open communication between workers and management can contribute to a robust safety culture.

Apart from the above, the summarise the safety enablers for construction activity is as follows:

Enhancing construction safety- requires a comprehensive approach encompassing risk assessment, training and education, equipment usage protocols, centralised resource systems, and establishment of a safety culture. Adhering to these principles not only helps prevent accidents and injuries but also fosters an environment of trust and accountability among all stakeholders involved in construction projects. Ultimately a safe construction site is just not a legal requirement but a moral obligation to protect workers and ensure long term project success.

Technical Article-10

ZERO ENTRY MINING IN SURFACE MINING OPERATIONS

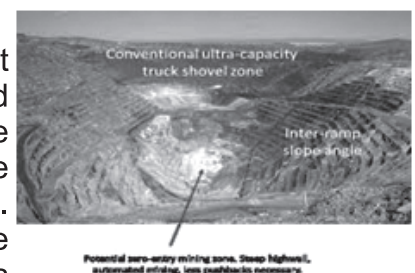
SATYABRATA BHOI, JE(MECH).
KIOM,KHANDADHAR

ABSTRACT

Zero entry mining operations are designed so that no-one need ever enter a mining zone. There is a strong business case to apply zero-entry mining in large surface mines that are exploiting ore bodies which are open at depth, or are mining zones subject to considerable risk. This study seeks to identify the gaps in current automation capability in order to achieve and to sustain zero-entry mining operations as applied to surface mines. The study also concludes that there is a need to develop an automated (or remote controlled) multi-functional platform capable of performing a wide variety of tasks, from geological grab sampling or as a mobile sensor platform along with assisting in moving lighting and communication infrastructure, electrical transformers and cables etc.

1. INTRODUCTION

In the last decade, mining and associated companies have made great progress regarding the introduction of autonomous haulage and blasthole drills in large bulk-mining surface operations. However, there are a number of mining operations around the world where geotechnical or geothermal hazards greatly restrict mining operations. An ideal solution would be the ability to extract material from these zones without anybody ever having to enter the hazardous zones. This



is known as “zero-entry mining”. Zero Entry Mining not only reduces risk exposure to personnel, but can also be a significant source of added economic value through higher utilization of equipment, reduced services (e.g. ventilation) and increased revenue through access to difficult to mine areas. for example, involve exploitation of ore at depth with steep pit walls, or mining underneath unsupported ground 2 which may involve unacceptable risk for personnel to enter the mining zone. Ultimately zero entry mining will enable the complete re-design of mines, mining equipment and mining methods in ways that were not possible if personnel were in the mining zone”.

Large metalliferous surface mine with ore deposit open at depth

In particular there is a strong business case to apply zero-entry mining in large surface mines that are exploiting oroboides which are open at depth (see Figure). In such mines, conventional extraction with large capacity equipment would proceed until the ultimate pit limit is attained. Then, using a zero-entry mining approach, smaller capacity autonomous systems could be used in conjunction with steeper inter-ramp angles near the base of the pit in order to scavenge remaining reserves There are many processes in conventional mining operations that require human intervention. Despite the great strides that have been made in mining automation, many gaps exist to achieve the ultimate goal of zero-entry mining in surface operations.

2. Objective

In Australia and elsewhere have changed the perception of risk in some parts of the mining industry, as well as accelerating the pace of adoption of digital technologies by the industry. This paper discusses these changes as well as progress towards resolving the previously identified challenges to zero-entry mining.

3. CURRENT AUTONOMOUS CAPABILITY

As applied to surface mining, autonomous capabilities are currently limited to blasthole drills and truck haulage. A number of companies have developed autonomous capability for blasthole drills, including Epiroc, Sandvik and Caterpillar. However, whilst rotary, pulldown and propel and navigation functions have been automated, some gaps exist even within the capabilities of commercially available drill rigs. One such gap is the ability to discriminate top-of-coal in overburden and interburden applications. Australia currently has some 220 autonomous haulage trucks (AHTs) in

operation, the largest fleet in the world. The principal suppliers of AHTs are Komatsu, Caterpillar and Hitachi. Interestingly, at the recent CIM conference in Toronto, Hitachi Mining and Construction announced that they intended to open their operating system to other vendors to facilitate greater interoperability between equipment from different vendors. Sandvik (Mining Monthly March 2019) has also committed to opening up its underground automation to other manufacturers through an API. One of the difficulties encountered with AHTs concerns loss of satellite signal. The Global Positioning System (GPS) works if four satellites are visible. Due to the extreme geography (mountains etc.) or very deep pits, it is possible for trucks to move into a satellite shadow. One solution to this is to employ positioning systems that can work with both GPS and GNSS, the Russian positioning system. Another solution is to employ a number of pseudosatellites which provide an artificial satellite signal to supplement those satellites in shadow. Zero-entry mining activities at the base of a deep pit may have to consider the additional expense of investing in a number of pseudo satellites to supplement GPS and GNSS

4.1 Surveying - Pre-dig preparation

In many conventional surface mines a surveyor is responsible for establishing dig limits on mining benches as well as delineating grade and contaminant zones. Typically this requires that the surveyor use stakes with different coloured tape. Modern GPS dig control systems installed onboard diggers can replace the need to stake out ground. Dig zones can be updated and downloaded via the mine intranet system to the diggers. The Argus™ shovel monitor from Komatsu Mineware is one such system (see xx). Thus technological solutions exist to assist pre-dig surveying, however some mines will need to invest in such systems if they desire to move towards zero-entry mining. Ultimately remote sensing 5 and augmented reality providing remote operators or automated systems with accurate geological or grade boundaries whilst operating will be needed.

4.2 Surveying - Surveying - Post-dig reconciliation

As benches are extracted it is necessary to reconcile extracted tonnes with the short term mine plan. This is done in order to control costs and to adjust for any deviation from plan. Some work has been undertaken on LIDAR scanning systems fitted to shovels in order to provide reconciliation (see Williams & McAree, 2008). However, the resultant maps are used to update the situational awareness of the shovel, and have not been fed back to update the mine plan; this provides an interesting possibility going forwards. The other alternative is the use of drones to fly over dump and excavation zones in order to reconcile material movements. Drones are now regularly flown in some large coal operations. There is no technical impediment as to why they cannot be applied to zero entry operations in surface mines. Applications such as Glass-Terra's Live Terrain take survey inputs from multiple inputs such as equipment and stationary LIDAR, drones, as well as manual survey reading to maintain a single Digital Terrain Model (DTM) that is then made available for all applications.

4.3 Geology - Data capture and sampling

In zero entry mines, it will no longer be possible for mine geologists to physically map or to collect chip samples from drills. Instead, a means of automated sampling or sensing whilst drilling or in hole after drilling will be required. This might be achieved with a general purpose mobile robotic platform with an adaptable tool set. Either this could be remote controlled or have some or all functions automated. An early prototype of this approach (as presented at Austmine 2019 Conference) is being developed by CRC Ore in conjunction with Imdex and Orica using a Universal Field Robotics platform as part of their Instrumenting the Bench initiative.

4.4 Engineering - Geotechnical stability assessment

As mining progresses new structural controls may be uncovered that require geotechnical assessment. In zero entry operations, a drone will have to be used to examine walls. However, 3D perception is required in order to assess the strike and dip of structures. Thus the drone will require a dual camera system in order to provide images in stereovision for a geotechnical engineer to interpret.

4.5 Operations - Wall control installation

Should a geotechnical assessment identify a high risk of failure, it may be necessary to install form of wall control in terms of bolts and mesh. This would require development of an automated drilling and bolting unit. Some R&D work has been carried out on autonomous bolting systems for underground applications by CRCMining.

4.6 Operations - Blasting services

Companies such as Orica have developed systems that combine GPS systems onboard explosive trucks with digital blast designs to control the loading of explosives into blastholes. However, priming a blasthole by inserting a detonator into a booster and lowering these into the blasthole is currently still a manual process. Some years ago, some R&D work was undertaken by CRCMining for the Savage River mine in Tasmania to enable remote priming of holes. This was in response to mining in the presence of an unstable hanging wall. More work needs to be undertaken here to enable automated priming. 6 The tie-in process to connect the blast pattern via NONEL tubes and delays is another process requiring dexterous manual hands. This is a case where some out-of-the-box thinking may be possible such as wireless detonation. Currently, a wireless initiation of explosives carries a risk of accidental detonations, particularly in the presence of stray electromagnetic fields. It is postulated that a dual frequency system may provide for greater safety and permit wireless detonation. This, in turn could eliminate the requirement for connection via NONEL tubes.

4.7 Operations - Autonomous digging

A muckpile of broken rock is an extremely unstructured environment for automated digger. Each bucket load taken from the muckpile causes a reorientation of the muckpile. Although much work has been done on automated LHD and front end loading, there is currently no system on the market that will manage unsupervised loading of shovels or hydraulic excavators. In addition to the tactical simultaneous location and mapping (SLAM) capability required to excavate a muckpile, autonomous diggers will also require mission planning algorithms to optimally guide them to extract a full bench.

4.8 Operations - Refuelling Refuelling of AHTs

could be conducted outside of the zero-entry autonomous zone, however this will contribute to a loss of production hours for the trucks. As with most large pit operations, it may be expeditious to adopt an in-pit refuelling strategy. This will require an autonomous refuelling strategy. Again, this gives rise to an opportunity to rethink refuelling; might it be more expeditious, for example to change out an entire fuel tank rather than trying to located and connect fuel hoses automatically?

4.9 Operations - Interoperability

A barrier to the uptake and interoperability of autonomous mining equipment in the mining industry is the lack of an agreed set of standards across the industry. OEMs employ different bus structures and there is little agreement on standard communication protocols. Toward this aim, the Global Mining Guidelines (GMG) group has established a number of working parties. GMG was first established by the oil sands operations in Alberta, Canada, but has grown in scope to encompass representatives of many of the major mining houses and OEMs. A supplement – and perhaps an alternative - to the development of interoperability standards is the concept of developing an “air traffic control” system for surface mining operations. Under such a system, the near surface land and airspace would be divided into different zones, with permission for machines to enter zones strictly policed by supervisory control software. Such a project has been put forward as part of a new Cooperative Research Centre bid around the introduction of Industry 4.0 concepts into mining.

4.10 Operations - Road and bench maintenance

To optimise AHT and digger performance and life expectancy there is a need to maintain haul routes and bench surfaces in good operational state. In a zero entry mine, this will require automated motor graders and wheel dozers. Whilst GPS is routinely used to enable “grade to design” on motor graders, it has not been used for direction and steering control. Thus, there is some development work necessary here. Opportunity exists to use 7 the sensor data from AHT (e.g. Strut pressures and

LIDAR) to identify areas requiring road maintenance and spillage.

4.11 Maintenance - GET replacement

As with lubrication and filter replacement, it may be necessary to replace wear parts such ground engaging tools (for example, dipper teeth and adapters) in the field. This, of course, assumes that rapid change out buckets cannot be employed, as such buckets can be returned to a central workshop for repair and reconditioning. Again, a new generation of dipper and bucket lips may need to be designed to suit autonomous change-out of ground engaging tools from first principles.

4.12 Mining services - Recovery systems

The reliability of equipment operating in zero-entry mines can be likened to mission critical applications, such as twin-engine extended range operations for airliners. This demands revised thinking on how to assure operations over a campaign life. However, inevitably some equipment failures will occur in-pit. It will then be necessary to recover the failed equipment. For a start, this is only feasible if equipment is size suitable to recover. Thus, large and/or ultra capacity equipment may be ruled out in zero entry operations. A remote controlled recovery rig would be required to tow, or transport, equipment out of the zero-entry zone. Something like an oversized airport tug can be envisaged, or a remote-controlled flat bed.

4.13 Mining services - Pumps, power, lighting

Continuous provision of services such as lighting, power and pit dewatering are a routine consideration of any mining operation. With regards to electrically powered equipment, there is a need to move transformer stations, relocate cable bridges, move cables, all of which may best be performed in a zero-entry mine under remote control. Although it may seem strange to maintain lights in a fully autonomous mine, a lighting station can double as camera pod and/or a communications station to enable supervision of mining operations at night and in periods of low visibility. There is a need to develop a remotely controlled multi-purpose services vehicle to enable these tasks. Such a vehicle could be extended to cover basic service inspection and maintenance tasks. Some work has been done in remotely controlled service vehicles for underground mines by Inco in Canada (Now Vale) and CSIRO in Australia.

CONCLUSIONS

There is a strong business case to apply zero-entry mining in large surface mines that are exploiting oroboides which are open at depth or are mining zones subject to considerable geotechnical or geothermal risk. This study seeks to identify the gaps in current automation capability in order to achieve and to sustain zero-entry mining operations as applied to surface mines. The study identified a list of fourteen initiatives associated with mine geology, surveying and engineering, operations, maintenance and mine services. By considering the applicability of these automation initiatives to current surface mining operations, a suggested development time frame is suggested for developing solutions to these gaps. It is interesting to note that operations initiatives (such as interoperability) take priority, as these have an immediate applicability in current surface mining operations. The exception to this is Ground Engagement Tools (GET) replacement robotization where there is a clear OH&S benefit. Surveying, Engineering and Mine service initiatives have lower development priority. There is a clear warning here for the mining industry not to neglect the development of these applications. The study also concludes that there is a need to develop an automated (or remote controlled) multi-functional platform capable of performing a wide variety of tasks, from geological grab sampling to assisting in moving lighting and communication platforms, electrical transformers and cables.

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Technical Article-11

CONFINED SPACE ENTRY (CSE)

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HSE (Project)

Introduction

Confined spaces, often shrouded in an aura of danger and mystery, pose unique challenges to those who must venture into these concealed environments as part of their professional undertakings. From navigating complex industrial boilers to conducting maintenance in compact storage tanks or entering narrow manholes, each entry into a confined space demands caution, awareness, and skill. As a result, confined space entry training, comprehensive and well-structured, plays an indispensable role in preserving the safety of those courageous enough to step into these demanding spaces.

Definition

Spaces that are enclosed, or largely enclosed, and threaten the health and safety of workers due to the **risks of fire, explosion, asphyxiation, drowning, or loss of consciousness** are by definition confined spaces.

There are 3 criteria which has to be satisfied to called an area as confined space

- (1) Is large enough and so configured that an employee can bodily enter and perform assigned work
- (2) Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry.)
- (3) It is not designed for continuous employee occupancy.

Examples of confined spaces are: Storage tanks, Silos, Manholes, Sewers etc.

In India, there is a significant lapse in data available on safe working practices in confined spaces along with a lack of awareness of safety standards required to execute work in these situations. Around **48,000** people died at work in India annually, according to a study by the International Labour Organization.

Hazards

Confined spaces present a multitude of hazards, from limited entry and exit points to hazardous atmospheres, risk of engulfment, and physical dangers like moving parts or electrical hazards. These potential threats require workers to have a deep understanding and ability to identify such risks. Comprehensive and ongoing training is essential for ensuring employees are well-prepared to mitigate these risks effectively. This training should target the specific hazards of confined spaces, equipping workers with the skills to recognize, respond to, and manage these risks. Furthermore, this training should be part of an employee's ongoing professional development, updated regularly to align with industry best practices and regulatory changes. Hands-on and scenario-based training techniques can provide a realistic experience, allowing workers to practice their responses in a controlled environment, thereby improving their confidence and preparedness for real-world situations. With these trainings, organizations can transform potentially dangerous confined spaces into safer work environments.

Safety Equipment (PPE)

In the world of confined space safety, equipment is far more than mere tools – it's a lifeline, a crucial ally in the battle against the unseen dangers lurking within these spaces. Personal protective equipment (PPE), for example, serves as the first line of defense, and gas detectors act as silent sentinels against hazardous atmospheres. The effectiveness of these tools, however, hinges on proper knowledge of their use and maintenance. Without the right training, these tools can give a false sense of security, rather than serving as reliable shields.

The necessary Personal Protective Equipment (PPE) for confined space entry can vary depending on the specific hazards of the confined space in question. However, here is a general list of PPE that may be required for confined space entry:

1. **Respiratory Protection:** Depending on the air quality in the confined space, different types of respiratory protection may be needed. This can range from air-purifying respirators for spaces with airborne contaminants to self-contained breathing apparatus (SCBA) for spaces with low oxygen levels or toxic atmospheres.
2. **Protective Clothing:** This can include coveralls, chemical protective clothing, or other forms of body protection to protect against hazards such as chemicals, heat, or sharp objects within the confined space.
3. **Eye and Face Protection:** Safety glasses, goggles, or face shields may be necessary to protect against dust, flying particles, chemical splashes, or other hazards.
4. **Hand Protection:** Depending on the work being performed, different types of gloves may be needed to protect against hazards such as chemicals, heat, or sharp objects.
5. **Head Protection:** Hard hats can protect against falling objects or bumps against hard surfaces within the confined space.
6. **Foot Protection:** Safety boots or shoes, potentially with steel toes, can protect against falling objects or sharp objects on the ground. Slip-resistant soles might also be needed depending on the conditions.
7. **Hearing Protection:** If the confined space has high noise levels, earplugs or earmuffs may be necessary.
8. **Safety Harness and Lifelines:** These are critical for non-entry rescue and fall protection, allowing a worker to be safely retrieved if they become unconscious.
9. **Personal Gas Monitors:** These devices can alert workers to dangerous levels of specific gases, such as carbon monoxide (CO), hydrogen sulfide (H₂S), or lower levels of oxygen.
10. **Non-sparking Tools and Equipment:** If the confined space has a potential for flammable or explosive atmospheres, it's important to use tools and equipment that won't create sparks.

Emergency Response and Rescue Operations

An effective emergency response plan forms the backbone of safety measures in confined space work. This plan should detail the rescue procedures, including immediate actions, communication protocols, evacuation routes, and first aid procedures. Having trained on-site rescue teams is essential, as time is of the essence during emergencies. These teams should be equipped with rescue equipment suited to the confined space conditions and trained in advanced first aid and life support to provide immediate medical assistance. Regular emergency drills should be conducted to ensure that everyone is well-versed with their roles in emergency situations. Additionally, the effectiveness of rescue operations can be further improved by incorporating feedback from past rescue missions and drills, identifying, and addressing bottlenecks or issues in the rescue process. This constant evaluation and iteration of the rescue strategy helps ensure that the response to any emergency is swift, coordinated, and effective.

Technical Article-12

How to Stay Safe and Healthy in Mining: A Guide for Miners

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Mining is a vital industry that provides raw materials for various sectors and creates jobs and income for millions of people. However, mining is also one of the most dangerous occupations in the world, exposing miners to various risks and hazards that can harm their health and well-being.

In this article, we will explore seven common risks and hazards that miners face in their work, and how they can protect themselves against them. By following these tips and guidelines, you can reduce the chances and severity of injuries and illnesses, and improve your health and safety in mining.

1. Dust: The Invisible Enemy

Dust is everywhere in mining, especially in underground mines. Dust can come from different sources, such as drilling, blasting, crushing, loading, transporting and processing of ore and coal. Dust can contain harmful substances, such as silica, asbestos, metals, radon and coal dust.

Dust can cause serious respiratory diseases, such as silicosis, asbestosis, pneumoconiosis, lung cancer and chronic obstructive pulmonary disease (COPD). Dust can also irritate your eyes, skin, nose and throat, and trigger allergies and asthma.

To protect yourself from dust, you should:

- ❖ Wear a respirator or a dust mask that fits well and filters out the dust particles.
- ❖ Use wet methods or dust suppression systems to reduce the amount of dust in the air.
- ❖ Maintain good ventilation in the work area to dilute the dust concentration.
- ❖ Avoid eating, drinking or smoking in dusty areas.
- ❖ Wash your hands and face before eating or drinking.
- ❖ Shower and change your clothes after work.

2. Noise: The Loud Threat

Noise is another common hazard in mining, especially in surface mines. Noise can come from different sources, such as blasting, drilling, machinery, vehicles and tools. Noise can damage your hearing, cause tinnitus (ringing in the ears), stress, fatigue, hypertension and cardiovascular diseases.

To protect yourself from noise, you should:

- ❖ Wear ear plugs or ear muffs that reduce the noise level.
- ❖ Use noise-reducing equipment or techniques, such as mufflers, silencers or dampeners.
- ❖ Limit the duration and intensity of noise exposure.
- ❖ Avoid working near loud sources of noise or use barriers to block the noise.
- ❖ Have regular hearing tests and check-ups.

3. Vibration: The Shaky Danger

Vibration is another common hazard in mining, especially in underground mines. Vibration can come from different sources, such as blasting, drilling, machinery, vehicles and tools. Vibration can affect your muscles, bones, joints, nerves, blood vessels and organs.

Vibration can cause musculoskeletal disorders (MSDs), such as back pain, neck pain, shoulder pain, hand-arm vibration syndrome (HAVS) and whole-body vibration syndrome (WBVS). Vibration can also damage your nerves, circulatory system, digestive system and reproductive system.

To protect yourself from vibration, you should:

- ❖ Wear anti-vibration gloves or pads that absorb the vibration.
- ❖ Use vibration-reducing equipment or techniques, such as dampeners, isolators or balancers.
- ❖ Limit the duration and intensity of vibration exposure.
- ❖ Avoid working with vibrating tools or machines for long periods or at high frequencies.
- ❖ Have regular medical check-ups and examinations.

4. Heat: The Scorching Risk

Heat is another common hazard in mining, especially in underground mines. Heat can come from different sources, such as geothermal gradients, machinery, vehicles and lighting. Heat can raise your body temperature and cause dehydration and electrolyte imbalance.

Heat can cause heat stress, heat exhaustion, heat stroke, dehydration and electrolyte imbalance. Heat can also affect your mental performance, alertness and decision-making.

To protect yourself from heat, you should:

- ❖ Wear light and breathable clothing that allows sweat evaporation and heat transfer.
- ❖ Drink plenty of water and fluids that replenish electrolytes and prevent dehydration.
- ❖ Avoid alcohol, caffeine and other diuretics that increase fluid loss and dehydration.
- ❖ Use cooling devices or techniques, such as fans, air conditioners or water sprays.
- ❖ Take frequent breaks and rest in shaded or cool areas.
- ❖ Monitor your body temperature and signs of heat-related illnesses.

5. Radiation: The Invisible Killer

Radiation is another common hazard in mining, especially in uranium mines. Radiation can come from different sources, such as radon gas, radioactive minerals, x-rays and gamma rays. Radiation can penetrate your cells and damage your DNA and chromosomes.

Radiation can cause radiation sickness, cancer, genetic mutations and birth defects. Radiation can also affect your immune system, blood system and reproductive system.

To protect yourself from radiation, you should:

- ❖ Wear a dosimeter or a radiation badge that measures the amount of radiation exposure.
- ❖ Use shielding materials or techniques, such as lead, concrete or water that block or reduce the radiation intensity.
- ❖ Maintain a safe distance from the radiation source or use remote control devices to operate the equipment.
- ❖ Limit the duration and frequency of radiation exposure.
- ❖ Follow the ALARA principle (As Low As Reasonably Achievable) to minimise the radiation dose.

6. Chemicals: The Toxic Threat

Chemicals are another common hazard in mining, especially in processing plants. Chemicals can come from different sources, such as explosives, solvents, reagents, fuels and lubricants. Chemicals can react with your skin, eyes, nose, mouth and lungs.

Chemicals can cause chemical burns, skin irritation, eye damage, respiratory problems, poisoning and organ damage. Chemicals can also affect your nervous system, endocrine system and metabolic system.

To protect yourself from chemical, you should:

- ❖ Wear personal protective equipment (PPE) such as gloves, goggles, masks and suits that prevent contact with the chemical.
- ❖ Use safe handling and storage practices, such as labelling, sealing, ventilating and disposing of the chemical.
- ❖ Follow the material safety data sheet (MSDS) or the safety data sheet (SDS) that provide information on the chemical properties, hazards and precautions.
- ❖ Seek medical attention immediately if you experience any symptoms or signs of chemical exposure.

7. Psychosocial: The Mental Challenge

Psychosocial is another common hazard in mining, especially in remote and isolated mines. Psychosocial can come from different sources, such as work stress, fatigue, shift work, long hours, isolation, loneliness, boredom and violence. Psychosocial can affect your mental health and well-being.

Psychosocial can cause mental health problems, such as anxiety, depression, post-traumatic stress disorder (PTSD), substance abuse and suicide.

To protect yourself from psychosocial, you should:

- ❖ Maintain a healthy work-life balance, such as having regular breaks, hobbies, social activities and family time.
- ❖ Seek support from your colleagues, friends, family or professional counsellors if you feel stressed, depressed or lonely.
- ❖ Join a peer support group or a wellness program that offers coping strategies and resources for miners.
- ❖ Report any incidents of harassment, bullying or violence to your supervisor or manager.

Conclusion

Mining is a rewarding but risky profession that requires constant vigilance and precaution. As a miner, you have the responsibility to protect yourself and your colleagues from the various risks and hazards that you encounter in your work. By being aware of the common risks and hazards, and by taking appropriate measures to prevent and control them, you can ensure your health and safety in mining. Remember, your health and safety are your most valuable assets. Stay safe and healthy!

Technical Article-13

HEALTH & SAFETY IS PRIORITY, MINING IS PROSPERITY

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Lanjiberna Limestone and Dolomite Mine (Dalmia Cement Bharat Limited)

Dalmia Cement is the only company with at least one plant in each of the four key eastern states of West Bengal, Bihar, Jharkhand and Odisha. The company offers a range of cement variants through its brand portfolio of three marquee brands: Dalmia Cement, Dalmia DSP and Konark Cement.

Its Cement Plant is one of the most modern dry process cement plants in India. The cement manufactured by DCBL is the market leader in Odisha and has emerged as a brand synonym of premium quality cement. The unit predominantly manufactures Portland Slag Cement, Portland Pozzolana Cement and Composite Cement through grinding and is catering to the coastal, northern and southern belts of Odisha.

The cement plant meets the limestone requirement from its Limestone and Dolomite Mines spread over an Mining Lease Area of 873.057 Ha located at villages – Alanda, Bihabandh, Jhagarpur, Kesramal, Raiberna, Katang, Dhauraada, Lanjiberna and Kukuda, Tehsil – Kutra and Rajgangpur, Dist – Sundargarh, Odisha.

Towards safety excellence journey, Dalmia cement has implemented 13 Safety Standards including Mines Safety which is basically made by incorporating all the mining statutory guideline (DGMS). As per DGMS Circular No. 06 of 2020, all the HEMM has been maintained with safety features. Some glimpses of safety initiative taken at Lanjiberna Mines are as follow-

Building Healthy Work Culture

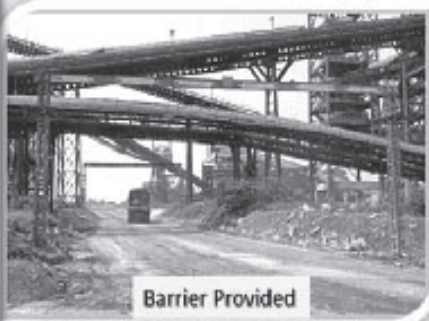
Enforcement of Zero Tolerance policy for Alcohol consumption at work place

Benefit :

- ✓ Improved discipline
- ✓ Reduced absenteeism
- ✓ Enhanced safe work culture
- ✓ Enhanced healthy work environment
- ✓ Improved employee engagement and productivity

Reliable & Green

Improvements at Mines Pit



Barrier Provided



Road Junction



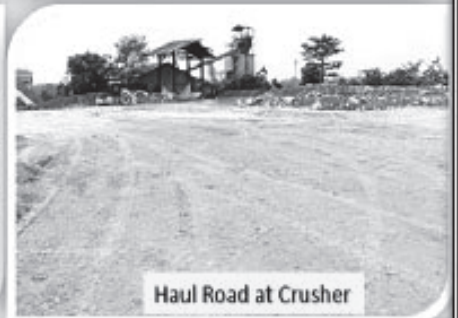
Haul Road at Mines



One way Road



Safety Berm



Haul Road at Crusher

Improvements in HEMM



Fatigue Monitoring



Rear Vision



3 Point Seat Belt



Dump Body LOTOTO



Tyre Stand



Life Jacket for Pump Team



Dumper Checks/symbols

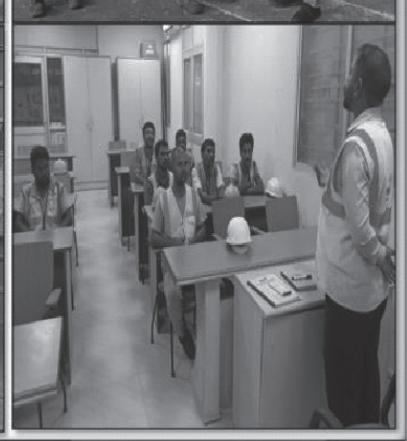
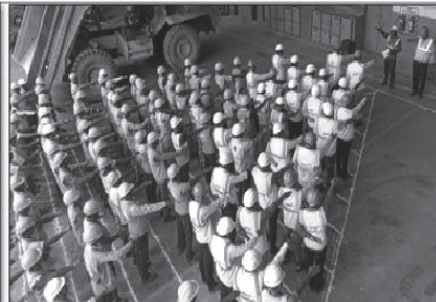


Battery Cut-Off switch



Mega Housekeeping

Employee safety- TBT, Hindi SOP, Gate meeting involvement & training



Dalmia Cement Mines Safety culture involves everyone and is based on the company-wide understanding that safety is priority number one. The entire organization is aligned in respecting, providing and striving for a safe work environment. Installing a mining safety culture within the workplace improves mining safety and impacts how employees feel about their company, increasing their positive feelings about their organization.

“SUCCESS WILL ALWAYS BE WITH YOU, AS LONG AS YOU PLACE SAFETY AS THE FIRST PRIORITY”

Technical Article-14

Digital Interventions for Safe Mining Operations

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Abstract:

In pursuit of driving the vision of Better Every day, JSW thrives to continuously innovate to cope with the fast-paced world and transform its business operation safer through digital interventions. To drive Digital Transformation, JSW has laid down a roadmap to leverage digital across the mining value chain to achieve its business objectives, improve operational efficiency, safe mining operations, reducing operational related injuries & fatalities, curtailing man machine interactions.

1. INTRODUCTION

The Mines & Metal industry is developing at very fast pace, the demand of the raw materials & end products is like never before. To suffice the need of increasing market demand at competitive price, the industry needs to innovate and transform its production & business strategy to improve operational efficiency at reduced cost. To drive the revolution and to be future ready, the organizations need to leverage the potential of Digital across the mining value chain to enable achievement of Business objective at improve efficiency and reduced cost and ultimately to remain competitive in the market.

1.1 JSW IN BRIEF

JSW's journey began in 1982 with the first steel plant at Vasind, near Mumbai. Since then, JSW has been expanding to become India's leading integrated steel company with a capacity of 28 MTPA and a target of achieving 37.5 MTPA by FY25. To accommodate the business, JSW is operating 14 Manufacturing facilities and 13 Iron ore mines in India.

JSW Steel Ltd. started its Mining operation in Odisha in July 2020 by acquiring 4 Iron Ore mines (i.e., Jajang, Gonua, Nuagaon, and Narayanposhi) with a combined EC capacity of 25.6 MTPA, and it gradually increased to 27.99 MTPA. JSW Steel Odisha mines division aims to expand the EC capacity to 35.79 MTPA by 2030.

Along with Mines, JSW's ongoing projects in Odisha include 30 MTPA Central Processing Unit (CPU – Screening & Crushing) and 30 MTPA Beneficiation plant to enrich the iron ores excavated from mines. To reduce the on-road burden and to optimize the logistic activity, JSW is setting up a 30 MTPA mineral grinding unit and a 300 Km Slurry Pipeline of 30 MTPA from Nuagaon to Paradeep, Jagatsinghpur, Odisha. With 300 Km length and 850 mm diameter, it will be India's longest and the world's largest slurry pipeline. JSW has also proposed setting up a 12.5 MTPA Integrated Steel Plant at Paradeep to enhance the steel production capacity further.

1. JSW DIGITALIZATION JOURNEY

Every challenge is an opportunity to innovate and make the process more efficient and effective. Considering the Digital trends and their implications on the mining business, JSW intends to leverage digital across the mining value chain to achieve its business objectives, improve operational efficiency, reduce costs, and streamline operations.

JSW Steel has laid a road map for digital interventions as of the journey to “Digital Transformation” to create intelligent mines using IOT, RPA, AI, ML, etc. As of now, the Digital Logistic Management System, Track & Trace, fleet and fuel management, security & surveillance, and safety & compliance management system are underway. The aim is to utilize the innovations in digital to make operations more flexible, transparent, agile, and responsive to the ever-changing market dynamics.

JSW regularly carries out continuous improvement programs and does operational studies to identify the bottlenecks in existing processes. Then a comprehensive study is conducted to understand the functional requirements to mitigate the challenges. The aim is to intervene digitalization into the process, such as automating it and making it more efficient & cost-effective. Digital interventions enable data collection to do real-time monitoring & use it analytically and statistically to improvise the process further, thus improvising the operation recursively and continuously in the long run.

JSW, in collaboration with Govt. of Odisha, has done the POC and implemented a digitalized stack verification process, allowing 20K t stacks to be verified in one go while ensuring the authenticity and transparency of the process.

In collaboration with the Ministry of Railways, JSW integrates its Digital Logistic Management System (DLMS) with the Freight Operation Information System (FOIS) for real-time monitoring of dispatching rakes and to ensure digital accounting of every transaction. Various automated reports are being generated, such as hourly dispatch reports, permit reports, transporter reports, siding reports, quantity & quality reports, etc.

1.1 DIGITALIZATION PROJECTS

In the first phase of the Digitalization wave, JSW has identified and is working on the following Projects–

- ❖ Digital Logistic Management System (DLMS)
- ❖ Track & Trace
- ❖ Fuel Management System
- ❖ Fleet Management & Vehicle Health Monitoring System
- ❖ Smart Safety, Security & Surveillance system
- ❖ Drone Management System

2.1.1 DIGITAL LOGISTIC MANAGEMENT SYSTEM (DLMS)

To optimize end-to-end logistic operation, JSW has implemented DLMS to integrate pit-to-port-to-plant logistic operations. In the backend, the DLMS is integrated with i3MS, FOIS & SAP to make the process automated, validated, and more efficient. Various critical touchpoints such as weighbridges and Mines entry/exit gates are automated using IOT devices to reduce the in-mine TAT of dispatch trucks. A transporter management module is commissioned to generate digital DO in validation with i3ms, thus ensuring authorized mines entry through RFID validation. DLMS is integrated with FOIS to optimize rail dispatch by real-time monitoring of dispatching rakes and digital accounting of every transaction.

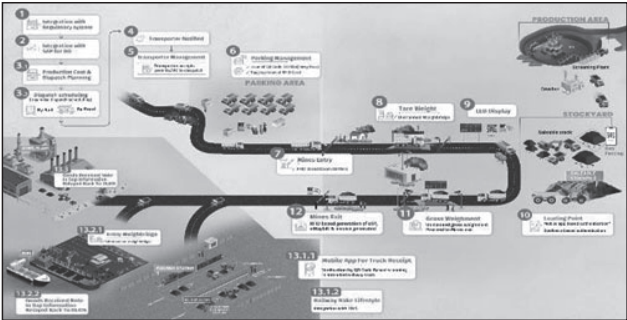


Figure 2: End to End Digitalized logistic process flow

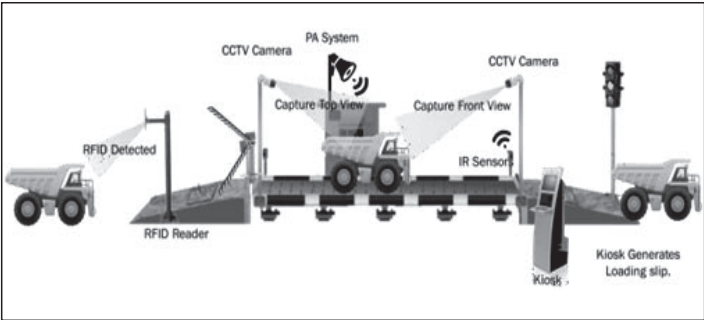


Figure 3: Automated Weighbridge component

A web-based dashboard is developed to visualize the e2e logistic operation in real time. The KPI dashboard enables users to monitor relevant KPIs in real-time and improvise the operations if needed.

This project has helped JSW to reduce the in-mine TAT of dispatch trucks by more than 50% and make logistic process free from human errors.

2.1.1 TRACK & TRACE

This enables tracking the real-time material movement through dispatch trucks and ensures on-time delivery & reduced pilferage. For live location tracking, each truck is fitted with GPS devices and is tagged to a particular geo-fenced route depending upon its source and destination. Once the truck gets diverted from its designated geo-fenced route, a real-time alert is generated on the live dashboards. Depending upon the events, the system can generate route deviation alerts, over-speeding alerts, over-halting alerts, delayed alerts, etc. The project's highlight is to get notified of an unwanted event to ensure on-time delivery and control pilferage while enroute.

The KPI dashboards generate automated reports such as permit-wise dispatch reports, alerts reports, transporter & driver performance reports, etc.

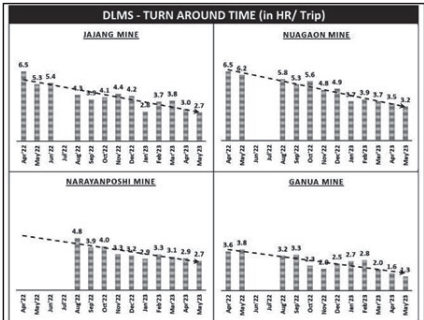


Figure 4: In-mine TAT reduction trend



Figure 5: Track & Trace dashboard for real-time dispatch truck monitoring

Technical Article-15

ECO-FRIENDLY SUSTAINABLE DEVELOPMENT BY USING SOLAR POWER PLANT

(ON ROOF OFF GRID SOLAR POWER PLANT)

Mr. Subham Patra Electrical Engineer

Ghoraburhani Sagasahi Iron Ore Mine M/s ArcelorMittal Nippon Steel India Ltd.

ABSTRACT:

Sagasahi mine has installed 60 KWP on roof solar power plant at our office area to supply the power requirement for office. Early the requirement is fulfilled by a 62.5 KVA DG, but it is not eco-friendly as it produced CO₂ to the environment.

LITERATURE & REVIEW:

Renewable energy (RE) sources such as solar is counted as clean energy sources, whose implication is becoming widespread. This source is mostly favourable because of their environmental-friendly features compared to conventional energy sources such as fossil fuels. Likewise, as a leading industry in raw material production, the mining industry is trying to take advantage of these systems in its different mining stages, from exploration to mineral processing but in our Sagasahi mines we are using it for powering the office work and illumination purposes and these solar panels are installed on containers rooftop its 60 KWP of solar power plant.

METHODOLOGY:

When the sun shines onto a solar panel, energy from the sunlight is absorbed by the PV cells in the panel. This energy creates electrical charges that move in response to an internal electrical field in the cell, causing electricity to flow.

INTRODUCTION:

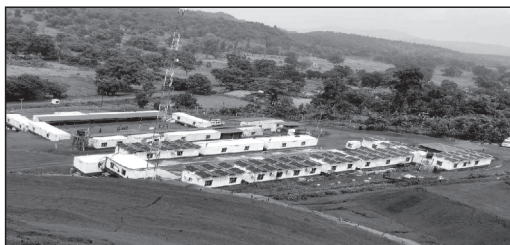
Solar power plant:

Solar power is a form of energy harnessed from the power and heat of the sun's rays. It is renewable, and therefore a "green" source of energy. In the solar photovoltaic system, solar energy is directly converted to electric power. This makes the system far more convenient and compact compared thermal system of energy conversion.

The solar cell technology is the fastest growing power generating technology in the world. It is due to fact that the solar cells with conversion efficiency of more than 40% are becoming available.

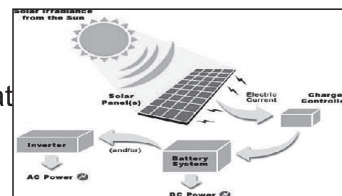
Photovoltaic effect

The photovoltaic effect is the generation of voltage and electric current in a material upon exposure to light. It is a physical and chemical phenomenon. The solar system works on this principle.

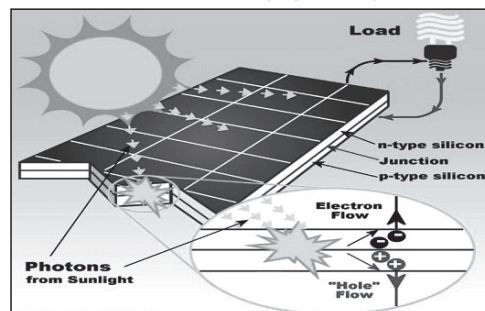


ADVANTAGES:

- ✓ Benefits of Solar Energy to the Environment.
- ✓ Reduction of carbon footprint
- ✓ Saving Money.
- ✓ Using Renewable Energy Source.
- ✓ Low Maintenance.
- ✓ Improving Grid Security.



(Fig no:-01)



(Fig no:-02)

FACTS AND FIGURES

Sagasahi mine has installed 60 KW on roof solar power plant at our office area to supply the power requirement for office. Early the requirement is fulfilled by a 62.5 KVA DG, but it is not eco-friendly as it produces CO₂ to the environment.

CONCLUSION:

Solar energy is a renewable form of energy it reduces our dependence on non-renewable sources like diesel generator which we use in our mines. Now we are using the rooftop solar panel which is not only saving our money but also reducing the carbon emission in the environment. We are using 60 KWP on roof off grid solar power plant at our office area to reduce the dependence on 62.5kva DG power supply which was not ecofriendly.

Technical Article-16

The Journey of Explosive and its effect on Blasting

Sujit Kumar Dash

Production Head, Thakurani Iron Ore Mines, AM/NS India Ltd

Journey So far:

The development of explosives has experienced a long history. Greek fire was first used in around 17th centuries. It was probably a mixture of naphthalene, quicklime & Sulphur. The black powder/low explosive(gunpowder) was invented in China in 9th century. The Low explosive was sensitive to water ,evolving black smoke and was weak in effect. In spite of these properties, it was highly used among all the mining industries until the evolution of high explosive by the Italian scientist in 1846.The Swedish inventor in 1862 first developed a high explosive of Nitro-glycerine composition. Subsequently capsule loaded mercury fulminate named detonator was introduced in the market and became popular for control blasting. Gradually ANFO, NONEL and many other forms of explosive introduced in the market.

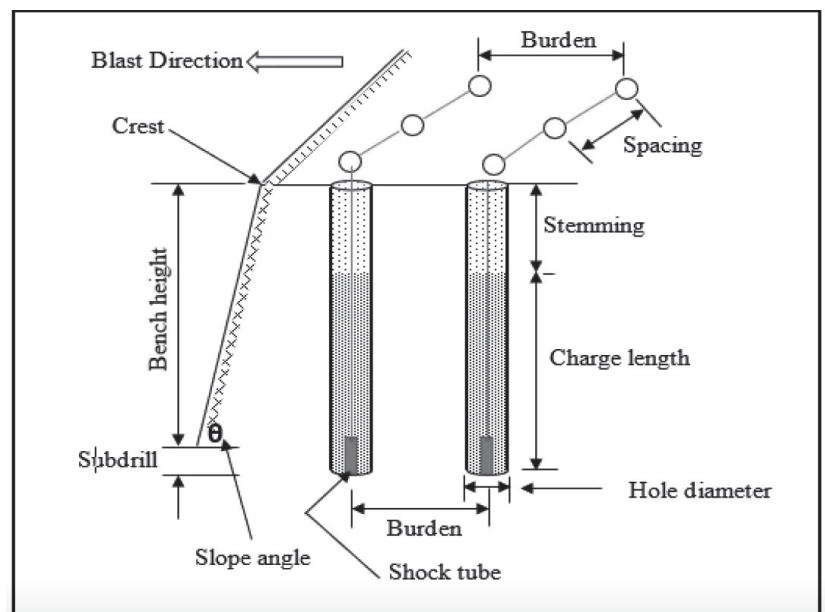
Factors affecting the efficiency of Explosive:

1. Design Factor
2. The Explosive in State Factor
3. The Rock and Environment Factor

Design Factor:

Rock Fragmentation requires some proceedings before the mass can be shattered into smaller sizes. The following factor influences the efficiency of the explosive usage and safety effect on the mine machines, nearby Building, Ground stability, Personnel safety to mention few:

- ❖ Drill hole geometry (Burden, Spacing, Stemming charge design, initiation technique, among others)
- ❖ Drill hole accuracy & direction into the rock mass. Several Debate on influence of the drill hole design was explored since decade. Poor hole design also influences the distribution of explosive energy during detonation as each burden distance has great impact on the shock front return time and disintegration efficiency during tensile slabbing. When available burden distance is inconsistent through out the drill hole column, the explosive energy tends to outperform in shorter distance and under perform in longer distance. This will result into undersize or oversize fragments.
- ❖ Explosive effect & environment. The Explosive state, including factors like type, quantity and initiation method, determines the release of energy. This in turn affects the size and velocity of the fragmentation generated during explosion. The blast environment such as confinement and proximity to structure can also can enhance the fragmentation due to reflection and interactions. Safety measures must consider these variables to mitigate the risks, including blast resistant structure, protective equipment and safe standoff distances.



Blasting and its effect:

Every mining operation which comprises of hard and soft rock requires blasting operation. The blasting operation makes the production smooth and rehandling of the material easily, but there are many consequences of the blasting on the environment which we need to address properly. Drilling and Blasting operation leads to form cloud of dust which may go to several meters before Settling and continue to move in the atmosphere for minutes. Other mining operations like dispatch leads to unsettle the Settled dust again. Due to this dust natural vegetates and environments. get polluted. Water pollution, air pollution land pollution is of the major impacts.

Some of the estimations for the quantity of dust produced have been either based on the area of the blast (EPA Report, 1932) or based on the quantity of explosive (Prasad 1995; Mukherjee 2001).

In one investigation, drilling operations produced 3.62 g/ton and blasting operations were measured to procure 72.5 g/ton of dust (NTIS 1976).

With the high production targets on mines, use of explosives Charge per hole increased tremendously which ultimately increase the amount of dust generation. Now, it is highly demanded to reduce the dust generation in the atmosphere and to study the process of dust generation and dispersion and steps that needed to be taken to reduce its generation and the dispersal of fines and dust. A research effort was initiated to Stimulate blast dust dispersal in different meteorological conditions and software were developed to predict dust plume movement-in and around times (Kumar & Bhandari, 2001, 2002).

Measurement is during, dust results from blasting very difficult and not many presentations / are research done for dust measurements after blasting. to US. EPA (1996) reports. dust measurements. Using ad blasting balloon sampler.

In order to reduce blasting dust some these parameters must be taken my consideration. Such as Burden spacing, stemming hole diameter, hole length, column charge, stemming length. effective sub-grade drilling, initiation Sequence, priming and ratio to blasthole diameter of charge dimeter.

- ❖ In Drilling process, one must design a blast pattern which is effective.
- ❖ Sub grade drilling helps in relieving the toe formation of the benches.
- ❖ Before Selecting explosive. One must study the lithology of the rock or benches to be" blast.
- ❖ Proper burden and Spacing help in controlling the and ground vibration will ultimately dust formation Class of Explosive and its amount also helps in this process. Dimensions of blast hole must be monitored as blast must move forward. Delay time plays a major role in As the Smooth muck mineral need bee fast to move.
- ❖ Powder factor must be monitored in order to reduce dust generation. PF is less than production of fines and dust also increases.
- ❖ Proper stemming materials and stemming length is also play vital role in dust control.
- ❖ Water filled ampoule in stemming is considered as safe stemming material and very much helpful in reducing dust and
- ❖ Water Sprinkling before blasting by inserting hole plug will also reduce the dust formation.

BLASTING OPERATION:

- ❖ PRIMING: The process of inserting the DTH into the cartridge.
- ❖ CHARGING: The process of inserting the cartridge into the hole.
- ❖ STEMMING: The process of covering of short hole with stemming material.
- ❖ 1st Siren (single): Before 30 minutes.
- ❖ CLEARANCE: Withdrawal of men and machinery outside the danger zone
- ❖ 2nd Siren (single): After area clearance.
- ❖ Deployment of safety guards at each entry point
- ❖ CONNECTION: Connecting the shot holes with TLD
- ❖ 3rd Siren (3times): Before firing the shot hole.
- ❖ SHOT FIRING: After final intimation from blasting in-charge Blaster blast the hole.
- ❖ After 5 min of blasting Blaster will inspect all the holes for checking any misfire.
- ❖ 4th Siren (single): After blasting final clearance.

CALCULATION & PROCESS FLOW CHART OF DRILLING OPERATION :

- ❖ Length of hole: 11m.
- ❖ Sub grade drill: 1 m (10% of hole).
- ❖ Diameter of hole: 102mm.
- ❖ Length of Cartridge: 0.45m.
- ❖ Diameter of cartridge: 83mm.
- ❖ Weight of cartridge: 2.78 kg.
- ❖ Stemming: 3.3m (30% of hole length).
- ❖ Booster length: 2.695m (35% of the remaining hole length).
- ❖ No. of booster: 6 (2.695m/0.45m).
- ❖ Length of column charge: 5.005m (65% of remaining hole length)
- ❖ No. of column charge: 11 (5.005m/0.45m)
- ❖ Burden: 2.5m
- ❖ Spacing: 3m
- ❖ No. of rows: 3
- ❖ Drill pattern: Staggered pattern
- ❖ Charge per hole: 47.26 kg
- ❖ Charge per delay: 330.82 kg

❖ ASSUMPTION:

- ❖ No. of rows: 3
- ❖ No. of holes in a row: 7
- ❖ Total no. of hole: 21
- ❖ Charge per delay: 330.82kg
- ❖ Total explosive used: 992.46kg
- ❖ Magazine location: Blleipuda.

$$\text{Power factor} = 6.2 \frac{\text{Ore produced (ton)}}{\text{Explosive used (kg)}}$$

$$\begin{aligned}\text{Ore produced} &= 2.5 \times 3 \times 21 \times 11 \\ &= 1732.5 \text{ cu.m} \\ &= 6063.75 \text{ te}\end{aligned}$$

$$\begin{aligned}\text{Charge factor} &= \frac{\text{Volume (cu.m)}}{\text{explosive used (kg)}} \\ &= \frac{1732.5 \text{ cu.m}}{992.46 \text{ kg}} \\ &= 1.7456\end{aligned}$$

$$\text{Detonation factor} = \frac{\text{Ore produced (ton)}}{\text{No. of detonator used}}$$

LITERATURE REVIEW:

In recent years open pit mines have developed rapidly with advantages such as high production efficiency, low input cost, and good safety. However, with the development of open pit mines towards green elaborate environmental pollution has become the biggest disadvantage of open pit mines (Gao and Liu 2010; Xie, 2014; Song et al, 2016; Song, 2020).

In open pit mine the dust in the pit is not easy to disperse due to the influence of natural conditions and geographical environment which negatively impacts the operation efficiency, health and safety of the workers (Gen, 2010; Bai et al, 2013; Gao 2013).

Dust is produced in all links during operation, but the link with the largest dust production is the



blasting operation before mining (Yan and Xue 2004).

According to the field measurements performed in this study, the instantaneous dust concentration during blasting must be as high as 4000 milligram per cubic metre exceeding the maximum allowable concentration of mine dust i.e., 10mg/m³ (Kissel, 2003; Barnewold and Lattermoser, 2020).

Some experts and scholars use numerical simulations or laboratory experiments to analyse and summarise dust migration rules and provide theoretical basis for dust control (Bhandari et al, 2004; Huang et al, 2019; Jia et al, 2021).

CONTROL MEASURES:

1. When magnesium chloride and calcium chloride mixed with water, it holds the dust firmly to the ground and do not allow to unsettle easily.
2. We can huge chemical demolition agents such as KATROCK, DEXPAN and FRACTAG as an alternative to blasting. As these are non-toxic chemicals and environmentally friendly, safe controlled demolition agents.
3. We can use water balloons within the stemming part resulting in formation of less dust
4. We must avoid blasting for soft rocks.
5. use of explosives must be calculated by studying rock type.

CONCLUSIONS:

1. Elimination - We should avoid blasting method for soft rocks but for the hard rocks we must practice blasting.
2. Substitution - We can substitute the type of explosive by studying the rock lithology and its quantity.
3. Engineering control - We can apply different methods to suppress the dust formation like
 - Water sprinkling throughout the area to be blasted.
 - Water ampules can be used as streaming materials.
 - Water balloons or plastic filled with water is placed between the stemming portions.
4. PPE (Personnel Protective Equipment) - We provide all necessary PPE to all the workers which helps in dealing in the hazards like face mask, gloves, goggles, ear plugs, earmuffs.

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Technical Article-17

SAFETY CULTURE

**Sri Subash Chandra Jayasingh Agent,
Gandabahali Graphite Mine, Agrawal Graphite Industries**

Minerals have played a major role in raising living standards of human beings. Different periods of civilisation such as stone age, Bronze age and nuclear age have been determined on the basis of usage of minerals. Any thing from pin to planes is the product of metals and their alloys. The sophisticated world of today is the result of enlarged use of minerals which is the gift of nature.

Exploitation of minerals is accident prone. It is wise to take preventive measures to avoid accidents in mining rather than to wait the accident to take place and then take remedial measures.

Labour productivity and safety are interlinked and inseparable. Safety and productivity are integral and dependent on each other. The present trend to use highly sophisticated equipment's with high capacity for mining and transportation has introduced many new problems such as maintenance of wall stability in deep pits, dust control in low horizons and suitable systems for correct maintenance and operation of large mining units. Introduction of heavy earth moving equipment's with deep hole blasting is to achieve greater volume of work with a much smaller number of workers than would be required with manual operation.

Accidents are undesirable events. It causes human sufferings, reduces production trend, dampens spirit to work, demoralises the work force and ruins the production planning. Accident to one cause sufferings to many.

General causes of accidents:

(1) Material causes :

- a) Slides of benches and piled material, falls of lumps and fragments of rock or ore.
- b) Falls of workers in the working.
- c) Accidents due to explosives during blasting, handling and transportation.
- d) Over loading of trucks and dumpers.
- e) Electrical accidents.
- f) Un-reliable equipment's, defective tools and appliances.

(2) Organisational causes:

- a) Unsuitable conditions of equipment's.
- b) Absence of guards and safety enclosures around machines and equipment's.
- c) Improper maintenance of road ways and passage ways, bench height, width and slope stability.
- d) Irrational methods followed to perform certain operations for production, repairs and maintenance.
- e) Lack of personal protective equipment's.
- f) Lack of proper supervision and guidance to the workers at work place.
- g) Inefficient lighting.
- h) Lack of training of workers/operative to maintain production and operate the equipment's with safety.
- I) Not framing traffic rules and code of practice.

General requirement for safe work has been enumerated in tabular form as per overleaf.

It is said that "A chain is no stronger than its weakest link". This is very much true in case of safety. No matter how sophisticated are the controls, the 'safety chain' always includes people which is the

weakest link. With a view to make this chain stronger the safety consciousness among the people has to be encouraged. In order to make people a stronger link in the safety chain there has to be a strong safety culture in the organisation. This safety culture is the summation of attitudes of personnel at all levels in the organisation.

Proper emphasis is to be given for proper training both theoretical and practical. The top executive is to set an example in this respect by encouraging people in all levels.

It is unfortunate that safety provisions are often viewed as necessary evils demanded by loss. However compliance of safety provisions will show profit within the overall performance of the organisation.

Better safety culture is a team work. It embraces industry, government department and labour union at large. Elaborate planning on safety and devoted efforts will make the safety culture a grand success. The safety officer must be a good motivator and persuade the employees at all levels to ensure safe working conditions and practices.

The functions of a safety professional will be more effective only when he directly reports to the chief executive of the organisation to enable implement the safety policies with great impact.

There are distorted perceptions, beliefs and concepts that safety jobs are separate, not connected with production. It is time consuming, involving money, unproductive, eye wash to fulfil the statutory obligations and they are best concern of only safety department.

Many a times, it is seen that people tend to compromise safety aspects as to complete the job fast. This approach has to be discouraged.

The safety and health policy approved by the management is to be issued to workers and supervisors in local language and explained to them for better understanding and easy compliance.

The duties of workers are to inform his immediate high authority any likelihood of imminent danger to their lives or health directly or through their representatives in safety committee. The management duty is to take immediate remedial action if he is satisfied about the existence of such danger.

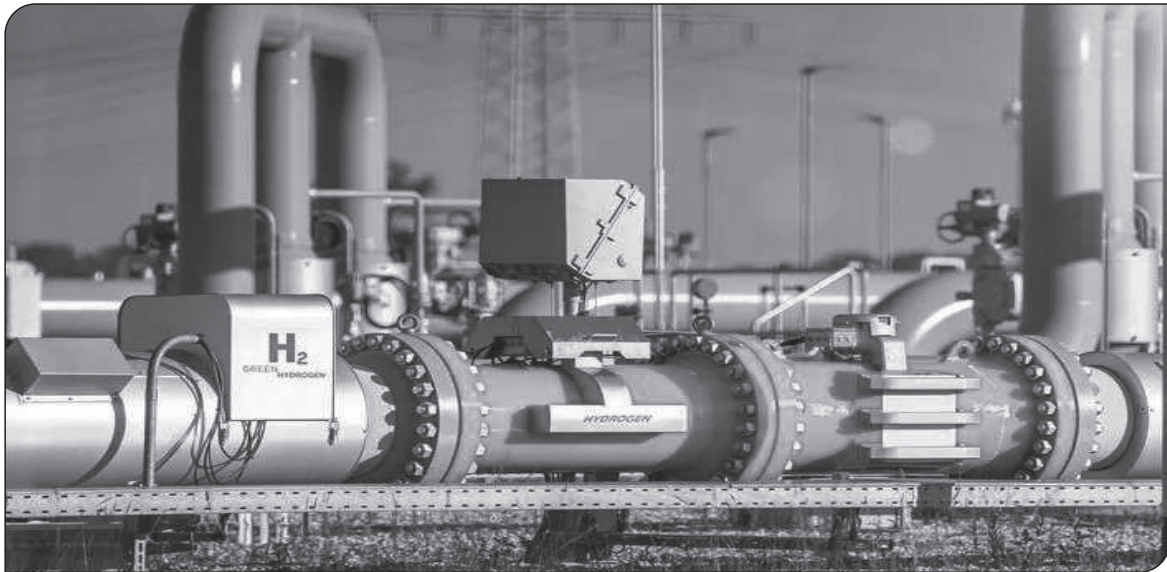
It must be ensured that safety can no longer be just given the lip service by the industry just sufficient to satisfy the statutory provisions. The safety officer has to play a positive, emphatic and decisive role guiding all levels of employees and employer in mankind the work place safe and healthy for all.

OUR AIM SHOULD BE

“Fight to the finish till accidents vanish”

Technical Article-18

India's quest for hydrogen energy clashes with water scarcity fears



In a significant development at the COP28 climate summit, a new report has highlighted a looming water crisis for India's hydrogen energy sector. According to the analysis by the International Renewable Energy Agency (IRENA) and Bluerisk, 99% of India's existing and planned green and blue hydrogen capacities face extreme water stress conditions by 2040.

The report, titled "Water for Hydrogen Production, underscores the water efficiency of green hydrogen, produced from renewable sources, as opposed to blue hydrogen made from natural gas with carbon capture and storage (CCS). It points out that green hydrogen, despite being the most water-intensive in its category, still uses nearly one third less water per kilogram of hydrogen produced than blue hydrogen.

"Our analysis sheds light on an overlooked aspect of hydrogen's role in the energy transition the water impact of clean hydrogen production.", some hydrogen production methods increase the risk of water stress, advocating for green hydrogen as a solution for achieving climate targets.

The global hydrogen industry's water demand is expected to more than triple by 2040 and increase six-fold by 2050, posing significant challenges, particularly for water-stressed regions like India. "Carbon capture and storage systems can cause hydrogen production's water demand to skyrocket.

The report also finds that over 80% of China's hydrogen production from coal occurs in the water-stressed Yellow River Basin, and a significant portion of Europe's hydrogen projects are likely to face high water stress by 2040. These global insights reflect a growing need for sustainable water management in hydrogen production.

For India, the report's findings call for integrating water considerations into hydrogen planning and project approval. This is critical given that more than a third of current and planned green and blue hydrogen projects globally are already in highly water-stressed regions.

The advancements in green hydrogen production technologies, such as air cooling and improved electrolysis efficiency, could further reduce water dependency. This is a crucial consideration for India, where adopting such technologies could significantly mitigate the water stress challenges associated with its hydrogen energy initiatives.

Technical Article-19

Implementation of Vehicle Safety Management System in Thakurani Iron Ore Mines (AMNS INDIA)

**Danveer, Assistant Manager
Arcelor Mittal Nippon Steel India Pvt. Ltd, Thakurani Mines**

The main purpose of developing a Vehicle Safety Management System mobile application for Heavy Earth Moving Machinery (HEMM) in mines is to enhance safety, streamline monitoring and reporting processes, and mitigate potential risks associated with these large and powerful machines. It can generate real-time alerts when any parameter exceeds safe limits, helping operators and supervisors respond swiftly to potential dangers. The app sends notifications to operators, maintenance teams, and supervisors when scheduled maintenance or safety inspections are due, reducing the risk of equipment failure. The app generates automated safety reports, reducing paperwork and the risk of errors. Supervisors, safety officers, and managers can access safety data and alerts remotely, providing them with better oversight of HEMM operations.

Approaches, Target Set, Measured & Achieved:

Developing a fully automated and digital platform for ensuring safety checking and generating reports in PDF and Excel formats is a significant step in improving safety compliance, reducing paperwork, and enhancing efficiency. Here's how the system aligns with your objectives:

- a. **Automated Safety Checking:** The system provides a digital checklist that inspectors must complete during safety checks. It includes built-in validation checks to ensure that all required safety fitments and braking system checks are performed as per DGMS guidelines.
- b. **Report Generation:** After the safety check, the system automatically generates reports in both PDF and Excel formats, including all relevant data and photographs. This significantly reduces the time and effort required for manual report creation.
- c. **Report Sharing:** The system automates the distribution of generated reports to the concerned persons, ensuring that they receive the information within the stipulated time. Email alerts can be sent to relevant parties with the attached reports.
- d. **Data Storage:** All safety check reports, and historical data are stored in a secure digital platform that is accessible from anywhere and at any time. This allows for easy retrieval of past records, simplifying compliance monitoring and audits.
- e. **Scheduled Safety Checks:** The system sends automated email alerts to the inspector two days before the scheduled safety check, ensuring they are prepared and aware of their responsibilities.

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Process Flow Diagram:

Software Building:

Kotlin is an expressive and concise programming language that reduces common code errors and easily integrates into VSMS apps. To build this app, we started with Kotlin to take advantage of its best-in-class features. When building new Android development tools and content, such as Jetpack libraries, samples, documentation, and training content, we will design them with Kotlin users in mind while continuing to provide support for using APIs from the Java programming language.

VSMS Interface

Results:

A thorough examination of current practices and concerns. To address the difficulties, we chose to use automation and digitalization. As per our requirements, we approached many outside providers to automate and digitize the process. A feasibility analysis was performed between the costing and the requirement. To tackle the difficulties within 30 days, it was decided to create a mobile application called VSMS by ourselves using programming. We ensured 100% statutory compliance by performing safety tests every two weeks.

41st ANNUAL MINES SAFETY WEEK 2023-24

Conclusion:

- ❖ We ensured 100 % statutory compliance by doing the safety checks in each fortnightly.
- ❖ Fully digitalized and automated platform by which we capture & share the reports of safety fitment checks automatically.
- ❖ Auto-alerting to inspector to do safety check well before schedule time so that chance of lapses is minimized.
- ❖ We get the detail history report of each equipment as & when required.
- ❖ Safety checking time reduced to 3 minutes per HEMM from 8 minutes per HEMM, thus save time and paperwork due to avoiding of manual and paper-based system.

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Technical Article-20

MAINTENANCE FUNCTIONS

WHAT IS MAINTENANCE?

- ❖ It guarantees all production-related machinery & equipment.
- ❖ It makes provisions for consumables & replacement parts for maintenance.
- ❖ In the industrial sector like function tests, maintaining, repairing, or replacing relevant devices, equipment & machinery processed.



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OBJECTIVES OF MAINTENANCE:

- A. Reducing breakdowns & emergency shutdown.
- B. Optimising resource utilization
- C. Reducing down time
- D. Improving spare stock control
- E. Improving equipment efficiency
- F. Reducing scrap rate
- G. Optimising the useful life of the equipment.
- H. Providing reliable cost & budgetary control



TYPES OF MAINTENANCE:

- ❖ Breakdown Maintenance
- ❖ Preventive Maintenance
- ❖ Autonomous maintenance

BREAKDOWN MAINTENANCE:

- ❖ Done after the machine breakdown.
- ❖ Operator informs to his team leader/Supervisor to raise a complaint to the maintenance team
- ❖ The team rushes to the machine & fixes the issue.

Sl.No.	Advantages	Disadvantages
1	Start-up cost low	Unpredictability
2	Lower maintenance expenses	Equipment not maximized
3	Higher potential margins	Indirect costs

PREVENTIVE MAINTENANCE:

- ❖ Done by maintenance team at regular intervals to keep the machine in working condition.
- ❖ Maintenance team would do scheduled based maintenance.
- ❖ Calendar should be created covering all major machine in the unit & person responsible for the same.

Advantages

1. The approach allows for scheduling modification to accommodate other works.
2. Energy Savings as a result of improving the efficiency of the equipment.
3. Reduced equipment or process failure
4. Overall saving

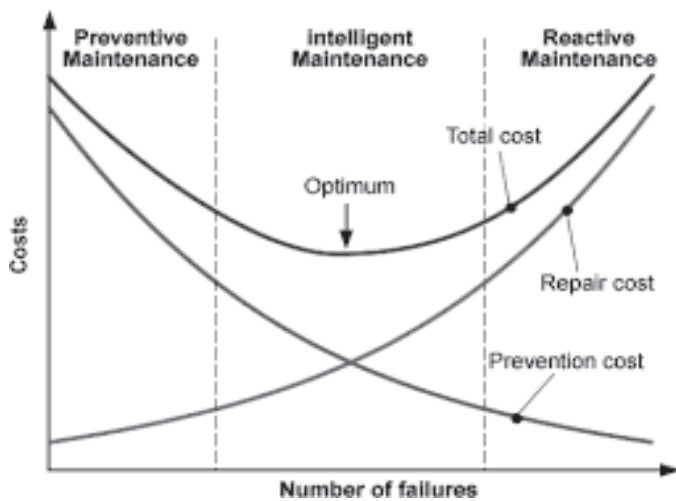
Disadvantages

1. When performing needless maintenance, there is potential harm.
2. Maintenance performed according to a schedule is not needed.
3. Savings are difficult to see without a base line.

AUTONOMOUS MAINTENANCE:

- ❖ It is part of preventive maintenance .Done by the operator by themselves on daily basis.
- ❖ CLITA-Cleaning, Lubrication, Inspection, Tightening, Adjustment
- ❖ Minor spare change can come under AM (Autonomous Maintenance)

MAINTENANCE COST



Technical Article-21

Lithium reserves- Jammu and Kashmir

SURBHI EXPLORATION

The recent announcement by India's Geological Survey of India on its preliminary exploration of lithium reserves has excited many industries dependent on the scarce alkali metal. According to the Geological Survey of India, it has established “**lithium inferred resources**” – which are calculated based on a physical and chemical study of the surface and samples – along the Salal-Haimana area of Reasi district in Jammu and Kashmir.

The news has given hope to manufacturers of lithium-based batteries, electric vehicles, solar equipment and other industries that are currently dependent on lithium imports from China and other countries. If the metal is available domestically, the battery production cost can come down 5% to 7%. India currently imports all the major components that go into the Li-ion cell manufacturing. “Lithium batteries comprise around 100-200 lithium cells for electric two-wheeler applications. Lithium cells are composed of elements like lithium, cobalt, manganese, nickel, copper, graphite and others. The advantage the domestic market can give us is a stable supply independent of evolving geopolitics.

The ambitious plan of the Indian government to achieve net zero by 2070 can potentially increase the demand for lithium. As the country races to transition to clean energy, there will be a higher need for lithium as electric vehicles and clean energy storage devices are currently dependent on the metal.

According to NITI Aayog, the total electric vehicle sales by 2030 could go up to 80 million. A report from the Central Electricity Authority claims that by 2029-30 India will have 2.700 megawatts of battery storage capacity.

Finding lithium

The Geological Survey of India originally mapped and reported the presence of lithium deposits in the region more than two decades ago, in 1999. Mapping by the Geological Survey of India is the very first step toward identifying any mineral. It is followed by the next phase of exploration where the inferred resources are calculated based on a physical and chemical study of the surface and samples.

The country took two decades to move from the **G4 (reconnaissance)** stage, where the mapping of resources takes place, to the **G3 (prospecting)** stage, where quantities are inferred, based on interpretation of geological, geophysical and geochemical results and a deposit is identified which will be the target for further exploration. In the next stage, **G2 (general exploration)**, more studies are done to estimate the minerals' shape, size and grade. And finally, the **G1 stage (detailed exploration)** is where characteristics of the deposit are established with a high degree of accuracy. A decision whether to conduct a feasibility study next, can be made from the information provided by the

G1 stage. The Geological Survey of India adopted this classification of mining exploration of the United National Framework Classification for mineral reserves of 2009.

G3 exploration in Jammu and Kashmir is preliminary in nature, where the calculation confidence is low. It needs to be backed by more proof to substantiate the quantum of minerals available at such sites. The current study does not indicate whether metal extraction is possible at the site. Exploratory companies undertake the G2 level of assessment after G3, where the indicative resources are calculated, which tells us how much of the deposit could be mined with more facts. Later in the G1 level, some minor exploratory mining is done to find if the area is ready for mining precisely, and the real 'proved resource assessment' is done at this level.

Early estimates indicate that the amount of lithium in Reasi could be to the amount of 5.9 million tonnes. As indicated in the 1999 report of the Geological Survey of India, though, the lithium in the Reasi district is mixed with bauxite. The final deposit amount could be less than predicted at the G3 level. The lithium found in Reasi had more than 800 parts per million quality, which hints at a higher level of enrichment. Any lithium mineral with more than 300 per million quality is considered of good enrichment value.

Why the progress of exploring such a crucial material, has been slow after 1999, is not clear. The emails sent by Mongabay-India to the Geological Survey of India headquarters in New Delhi, its public relations officer in Kolkata and the department of mines in the Jammu and Kashmir government didn't receive a response at the time of publishing. India also had another claim of lithium deposits, in 2021, when the India's Atomic Minerals Directorate for Exploration and Research claimed to find 1,600 tonnes of the metal in the Marlagalla area in the Mandya district of Karnataka. Lithium reconnaissance resource (found after G4 level of reconnaissance) are also explored along the Saraswati river in the Jodhpur and Barmer districts of Rajasthan in the brines. Lithium is traced and extracted from rocks, clays, sediments and the salty water (brine) on the surface of underground water bodies.

Mines to battery

Energy Programme at the World Resources Institute-India, told Mongabay-India that the recent Geological Survey of India discovery has a long journey before it becomes commercially viable to mine lithium from the region and makes it to the production of lithium-ion batteries.

We have to wait to see how much of this resource is feasible and viable to be commercially extracted. The Geological Survey of India's further study will reveal the quantum of the total reserve. Mining alone would not entail an end to external dependence. Countries like China have developed additional infrastructure and technological expertise, and experience in

processing and refining mined lithium to make it ready to be used in batteries. Lithium is known for effectively converting chemical energy into electrical energy due to its high durability, lightweight, and endurance. Unlike Chile, where there are lithium deposits, the Reasi region in Jammu and Kashmir had lithium mixed with other minerals into the rocks. It can lead to more challenges in terms of cost and technology of processing.

India is not habituated to extracting lithium and purifying it. It is mixed with rocks and other minerals. It would require breaking the rocks and removing volatile chemicals with evaporation and magnetic impurities with magnets besides other chemicals and processing. India has never done this, and neither has the best experience, tested technology to rely on, nor established industries for this.

"However, Australia has similar lithium reserves like Jammu and Kashmir reserve, where lithium is mixed with bauxite. We may need technology transfers and tie ups with the lithium metal extraction industry outside."



Fig- A lithium-ion battery: Battery manufacturers say that with the potential of domestic reserves of lithium, the battery production cost could come down in India.

The Himalayan region

According to the seismic zonation map of India, the whole of Jammu and Kashmir, which lies close to the Himalayas, comes under Zone IV and is also ecologically sensitive. Several international reports in countries where lithium mining takes place have talked about the impact of environmental degradation in such areas. The metal is generally extracted from the brines by direct extraction technology, evaporating the brine, or by surface mining of clay and rocks.

A report published in Nature Conservancy claimed that the proven technologies of lithium extraction through surface mining or brine evaporation would need hundreds of acres of land for extraction and could lead to the complete removal of native vegetation of the area. It also said that such projects are most likely to happen in rural areas and wild zones, affecting the local population and battling for sustainable mining methods for the metal. The Reasi district in Jammu and Kashmir, where the lithium deposits have been discovered, has rural households, vegetation and the Chenab river and tributaries near its hills.

Technical Article-22

Mechanization and Maintenance in Mines

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The mining industry has come a long way from the days of excavation through labours manually to highly equipped machineries. Today, mechanisation plays a crucial role in enhancing the productivity and safety of mining operations. The use of heavy machinery and advanced technology has revolutionized the sector, but with great power comes great responsibility. Proper maintenance is the key to ensure that these machines perform optimally and safely. Here, we will explore the significance of mechanization and maintenance in mines, highlighting the balance between efficiency and safety.

The Rise of Mechanisation in Mining

Mechanisation in mining involves the use of various machines and technologies to extract minerals and ores from the Earth's crust. This shift from manual labour to machines has greatly increased the speed and scale of mining operations, making it more efficient and cost-effective. Some key mechanisation technologies in mining include:

Excavators and Loaders: These heavy machines are used to dig, scoop, and transport materials from the mining site.

Drilling Equipment: Drills and rock breakers are essential for creating blast holes and breaking down rock.

Conveyors and Haul Trucks: These are responsible for moving materials from the extraction site to the processing or storage areas.

Automated Equipment: Advance in robotics and automation have introduced autonomous vehicles, remote-controlled machines, and even drones for surveying and monitoring.

Data Analytics and Sensors: Mines with modern machineries utilize data analytics and sensors to monitor machine health(On board Diagnostic), safety conditions, and predict maintenance needs.

Benefits and Challenges

The mechanisation of mining has brought a large number of advantages:

- ❖ **Efficiency and Productivity:** Mechanisation increases mining output and efficiency, meeting the ever-growing demand for resources.
- ❖ **Precision and Consistency:** Machines can perform tasks with a high level of precision and consistency, leading to more accurate and uniform results. This is particularly important in tasks like drilling, blasting, and ore sorting.
- ❖ **Faster Operations:** Mechanized mining processes are generally faster than manual methods. This speed can lead to quicker extraction, processing, and transportation of minerals, ultimately boosting productivity.

- ❖ **Safety:** Automation minimizes risks to human workers, reducing accidents and injuries.
- ❖ **Cost Reduction:** Reduced labour costs and improved efficiency contribute to lower operating costs.
- ❖ **Environmental Responsibility:** Sustainable practices and technology adoption contribute to a more responsible mining industry.

While mechanization in mining offers numerous benefits, it also comes with several challenges and considerations that need to be addressed to ensure its successful implementation. Here are some of the key challenges associated with mechanization in mining:

- ❖ **High Initial Investment:** The capital costs for acquiring and installing modern mining equipment and technology can be substantial. This initial investment can be a barrier, particularly for smaller mining operations or those in financially constrained regions.
- ❖ **Skilled Workforce Requirements:** Mechanized mining operations require a skilled and technically competent workforce to operate and maintain the equipment. There may be a shortage of such personnel in some areas, leading to recruitment challenges.
- ❖ **Training and Safety:** Mechanized mining demands rigorous training programs to ensure the safe operation of equipment and adherence to safety protocols. Failure to provide adequate training can result in accidents and injuries.
- ❖ **Environmental Concerns:** Some mechanized mining processes can have environmental impacts, such as increased energy consumption, emissions, and disturbances to ecosystems. Addressing these concerns may require additional investments in environmental mitigation measures.
- ❖ **Maintenance and Repairs:** While mechanized equipment tends to be more reliable, it still requires regular maintenance and occasional repairs. Downtime for maintenance can affect productivity, and maintenance costs need to be managed.
- ❖ **Equipment Maintenance Knowledge Transfer:** Ensuring knowledge transfer from experienced maintenance personnel to new workers is crucial to maintain equipment reliability. The loss of experienced personnel can pose challenges.

Safety Considerations in Machine Maintenance

Safety considerations in machine maintenance in mines are more important than anything else, as mining equipment is often large, complex, and potentially hazardous. Proper maintenance is crucial to ensure the safe and efficient operation of mining machinery. Here are some key safety considerations for machine maintenance in mines,

1. **Training and Competency:** Ensure that maintenance personnel are properly trained, certified, and have the necessary skills to work with heavy machinery. Ongoing training and competency assessments are crucial to stay up to date with evolving equipment.
2. **Lockout/Tagout Procedures:** Implement and strictly adhere to lockout/tagout procedures when performing maintenance to prevent accidental startup of equipment. This involves isolating energy sources and using locks and tags to secure them.
3. **Personal Protective Equipment (PPE):** Mandate the use of appropriate PPE, such as helmets, gloves, goggles, and safety boots, for maintenance personnel to protect them from potential hazards.
4. **Fall Protection:** In situations where maintenance personnel need to work at heights, provide fall protection systems, including harnesses and guardrails, to prevent accidents.
5. **Hazardous Materials Handling:** Ensure that maintenance staff are aware of and equipped to handle any hazardous materials they may encounter during maintenance tasks.
6. **Documentation:** Keep accurate records of maintenance activities, including inspections, repairs, and replacement of parts. This documentation can be useful for identifying trends and ensuring compliance with safety regulations.
7. **Emergency Response:** Have well-defined emergency response plans in place, including the location of emergency exits, first-aid stations, and communication procedures.
8. **Safety Inspections:** Conduct regular safety inspections of equipment and machinery to identify potential hazards and address them proactively.

Best Practices for Safe Machine Maintenance

Safe machine maintenance in mines is critical to ensure the well-being of workers and the efficient operation of mining equipment. Here are some best practices for safe machine maintenance in mines,

1. **Scheduled Maintenance:** Perform routine maintenance tasks according to a regular schedule to prevent equipment breakdowns and failures.
2. **Equipment Isolation:** Always isolate and lock out machinery before commencing maintenance activities to prevent accidental activation.
3. **Training and Competency:** Ensure that maintenance personnel are well-trained, competent, and certified to work on specific types of equipment. They should be familiar with safety procedures, potential hazards, and the correct maintenance techniques.
4. **Risk Assessments:** Conduct thorough risk assessments before maintenance tasks, identifying potential hazards and developing strategies to mitigate them.
5. **Use the Right Tools:** Ensure that maintenance personnel have access to the appropriate tools and equipment needed for the job. Using the correct tools can prevent accidents and damage to equipment.
6. **Communication:** Establish clear communication between maintenance personnel, equipment operators, and site supervisors to coordinate maintenance tasks and ensure safety.
7. **Documentation:** Keep detailed records of maintenance activities, including work permits, checklists, and safety reports, to ensure compliance and accountability.
8. **Safety Culture:** Always try to encourage a safety-first culture within the mining organization, emphasizing the importance of safety in all operations, including machine maintenance.

Mechanisation has significantly transformed the mining industry, making it more efficient and safer. However, to gather the full benefits of mechanisation, mines must prioritize proper maintenance to ensure that their machinery runs smoothly. By striking a balance between efficiency and safety, the mining industry can continue to evolve and meet the world's growing demand for natural resources while minimizing environmental impact and ensuring the well-being of its workforce.

Safety is non-negotiable in the mining industry, particularly when it comes to machine maintenance. Heavy machinery, hazardous materials, and challenging working conditions necessitate a strong commitment to ensuring the safety of maintenance personnel. By adhering to the best practices and safety considerations outlined in this article, mining operations can mitigate risks, prevent accidents, and maintain a safe working environment, ultimately ensuring the well-being of their workforce and the long-term success of the industry.

Technical Article-23

Advancements in Green Mining Technology: Paving the Way for Sustainable Resource Extraction

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Introduction

The extraction of valuable ores from the Earth's depths has fueled human progress for centuries, yet it has come at a tremendous cost to our environment. Mining practices, often driven by the insatiable demand for minerals and metals, have left a trail of unsustainability and environmental degradation in their wake. While these problems remain formidable, a ray of hope emerges on the horizon with the advent of "green mining" technologies and practices.

What is actually green mining?

Green Mining Defines a mixture of technological advances and best practices to achieve the extraction of minerals and metals while mitigating the Environmental Impacts of the Process.

TRANSFORMING MINING: SUSTAINABLE PRACTICES SHAPING THE FUTURE OF RESOURCE EXTRACTION

Green mining technologies and practices have been gaining attention in India as the country seeks to address environmental concerns and promote sustainable mining operations. Here are some examples of green mining technologies and practices adopted in India ;

Solar Power Integration:

Incorporating solar integration in green mining is the practice of using solar energy to power mining operations while minimizing the industry's environmental impact. By deploying solar panels or power plants on-site, mining companies can reduce their reliance on fossil fuels, lower greenhouse gas emissions, and lower operating costs.

Efficient Water Management:

Water scarcity looms as a pressing concern in numerous regions across India. In response to this challenge, mining companies are turning to innovative water management solutions to mitigate their environmental impact. Hindustan Zinc's Dariba Smelting Complex, nestled in the arid landscapes of Rajasthan, has set an inspiring example. By implementing water recycling and treatment systems, the complex recovers a significant portion of its process water, thereby minimizing water consumption and conserving this precious resource. In addition to these initiatives, mining operations utilize Effluent Treatment Plants (ETPs) to purify water used for vehicle washing. These ETPs effectively remove contaminants and pollutants from the water, showcasing mining companies' dedication to environmental responsibility and eco-conscious practices.

Biogas Plants

Biogas plants are being used to convert organic waste from mining operations into biogas, a renewable energy source primarily composed of methane. This sustainable approach reduces the need for traditional fossil fuels and helps lower the environmental impact, showcasing the mining industry's commitment to eco-friendly practices.

Green Transportation:

Indian mining companies are commencing on a transformative journey by incorporating electric vehicles (EVs) into their fleets. Mining companies now a days has enthusiastically adopted battery-powered EVs, revolutionizing the mineral transportation process within its mines. These electric vehicles not only promise a significant reduction in emissions but also provide a quieter and cleaner alternative to their diesel-powered counterparts.

Revolutionizing Mining with Sonic Drilling

Sonic drilling is a new era of eco-friendly mining, with its innovative mechanical oscillation drills that drills more quickly than conventional methods. This technology is particularly notable for its application in mining precious resources like diamonds, gold, and lithium. By reducing the use of drilling fluids and enhancing drilling efficiency, sonic drilling is not only streamlining resource

extraction but also significantly lowering the environmental impact of mining operations.

Solid Waste Management :

In the mining industry, organic waste from canteen doesn't go to waste. Instead, it is transformed into vermicompost, a nutrient-rich soil produced with the help of earthworms. This "black gold" is used in improving soil quality for reclamation projects, boosting plant growth, and reducing the need for chemical fertilizers.

Turning Waste Materials into Road-Building Resources

Mining companies are finding a new way to deal with waste. These materials are now being used as minor minerals. This approach is getting popular, especially for road repairs. Instead of discarding waste materials, mining companies are reusing them to create road-building materials contributing to sustainable and cost-effective road infrastructure development. By this the problem of space for storing waste material is solved and alternate use of waste material is accomplished.

Bioremediation:

Indian mining companies, like KIOCL in Karnataka, are using bioremediation techniques to reduce the environmental impact of mining. They're employing specially selected plants that can absorb and neutralize pollutants, helping to restore mined land and reduce soil contamination. This nature-inspired approach is a step toward making mining more eco-friendly. The Iron Mountain Mine in California is employing bioremediation techniques. Microorganisms are used to clean up the acidic and metal-laden waters that have polluted the region for decades, showcasing the potential of bioremediation in restoring ecosystems. Biosurfactants can be produced by bacteria like *Bacillus subtilis* to remove heavy metals from contamination by precipitation-dissolution, ion exchange, counter ion binding. Sophorolipids play a vital role in removing Iron, Arsenic and Copper from mine tailing.

Liquid emulsion technology

Acid mine drainage stands as a formidable environmental challenge, with far-reaching impacts on ecosystems. While several methods like biosorption, ion exchange, and chemical precipitation have been employed to combat this issue, they often come with their own set of disadvantages. In central Chile, they use liquid emulsion tech to clean copper from acid mine water. It's a more effective method, reducing mining's environmental impact.

M-Sand Technology

Mining companies have been actively exploring innovative solutions in the realm of green mining as part of its commitment to sustainable and environmentally responsible mining practices. One notable addition to their green mining initiatives is the incorporation of M-sand technology. Manufactured Sand (M-sand) is an eco-friendly alternative to natural river sand that is used in construction and infrastructure development. By adopting M-sand technology, CIL aims to reduce the environmental impact of mining operations while contributing to the conservation of river ecosystems. This sustainable approach not only ensures the availability of quality construction material but also aligns with the global effort to reduce the depletion of natural resources and safeguard the environment.

Belt Conveyors & Pipelines: Sustainable Mined Material Transport

Belt conveyors play a pivotal role in green mining practices, offering a sustainable and efficient way to transport mined materials. By reducing the need for truck transportation, these conveyors help lower particulate matter emissions and energy consumption. Additionally, they contribute to a safer work environment by minimizing vehicular traffic congestion in mining areas. This eco-friendly approach aligns with the mining industry's focus on reducing its environmental footprint while improving operational efficiency. In addition to belt conveyor, pipelines are also used to transport mined material over long distance with reduced energy and with a smaller environmental footprint. This innovative approach minimizes the traditional transportation methods, such as trucks etc.

Reduced Blasting Frequency:

Blasting may be reduced to three times in a month by increasing the quantity of explosives per blast by adopting optimizing techniques. By doing so, the detrimental effects associated with blasting, such as ground vibrations, noise, and air pollution, are significantly mitigated. In other way it will be beneficial as the loss of working hours due to blasting is reduced.

Sustainable dust control measure

The implementation of a sprinkling system in mines road and the installation of Dry fog system in mines signify step towards sustainable practices. These are reducing dust emission and conserving water resources. The DFS efficiently suppress the dust without using excess of water. The sprinkling system at mines road control the dust emitted and hence improving the air quality.

Continuous Ambient Air Quality Monitoring Systems (CAAQMS)

Continuous Ambient Air Quality Monitoring Systems (CAAQMS) have become an integral part of green mining initiatives. These advanced systems are strategically installed to monitor real-time air quality in and around mining sites continuously. Monitoring the levels of diverse air pollutants, including particulate matter such as PM10 and PM2.5 as well as gases like nitrogen dioxide (NO_x), sulfur dioxide (SO₂), carbon monoxide (CO), and others, aids mining companies in effectively overseeing and reducing potential environmental impacts.

Conclusion

Green mining technologies and practices in India are gradually gaining momentum, driven by a growing awareness of environmental and sustainability issues. These initiatives aim to strike a balance between mineral resource extraction and environmental preservation, contributing to a more responsible and eco-conscious mining sector. It may be noted that Green mining go hand in hand with health and profitability of the mining industry.

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Technical Article-24

Mineral Dust Hazards and Respiratory Safety in the Mining Industry

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Abstract:

The mining industry is essential for economic development, but its operations can generate a significant yet often underestimated hazard - mineral dust.

This article delves into the nature of mineral dust hazards in mining and emphasizes the indispensable measures that must be taken to protect the respiratory health of workers.

Understanding the types of dust, their sources, and potential health implications sets the stage for a discussion on effective respiratory safety measures.

Engineering controls, dust monitoring, personal protective equipment, education, and compliance with regulations are all integral components of a comprehensive approach to mitigate dust-related health risks.

By embracing these safety measures and embracing innovative solutions, the mining industry can continue to thrive while prioritizing the well-being of its workforce.

Introduction:

Mining is the bedrock of industrial progress, fueling economies with the resources they need to grow and prosper.

However, beneath the earth's surface lies a hidden hazard, one that poses a substantial risk to the



health of those who extract these valuable resources - mineral dust.

This article takes an in-depth look at the nature of mineral dust hazards in the mining industry and highlights the critical measures that are essential to protect the respiratory health of miners.

Understanding Mineral Dust Hazards:

Types of Dust:

- ❖ Mineral dust in mining operations encompasses a diverse range of particles, including but not limited to quartz, coal, metal, and rock dust.
- ❖ Among these, crystalline silica found in quartz is of particular concern due to its potential to cause silicosis, a debilitating and often fatal lung disease.

Dust Generation Sources:

- ❖ Dust is an omnipresent by-product of mining, generated at various stages in the process.
- ❖ Whether it's drilling, blasting, crushing, loading, hauling, or transportation, each phase has the potential to produce dust.
- ❖ Once airborne, these particles become easily inhalable, exposing miners to potential health risks.

Health Implications:

- ❖ Inhalation of mineral dust is not without consequences. It can lead to a spectrum of respiratory health issues, including silicosis, pneumoconiosis, and chronic obstructive pulmonary disease (COPD).
- ❖ Miners, who are often exposed for extended periods, are particularly susceptible to these afflictions.

Respiratory Safety Measures:

Engineering Controls:

- ❖ Effective dust control begins at the source. The implementation of engineering controls such as dust suppression systems, improved ventilation, and enclosed cabs in machinery significantly reduces the concentration of airborne particles.

Dust Monitoring:

- ❖ Frequent monitoring of dust levels within mining areas is pivotal in identifying high-risk zones.
- ❖ This allows for timely intervention to minimize exposure and reduce health risks.

Personal Protective Equipment (PPE):

- ❖ PPE, especially respirators with N95 or higher-rated filters, acts as a barrier between miners and harmful dust.
- ❖ Ensuring that workers wear suitable respiratory protection is paramount.

Training and Education:

- ❖ Education is a linchpin of safety. Training programs that educate workers about the dangers of mineral dust and the correct use of PPE are essential.
- ❖ An informed workforce is a safer one.

“Mineral Dust Hazards and Respiratory Safety in the Mining Industry”

Regulatory Compliance:

- ❖ Adherence to local and international mining regulations and standards is a non-negotiable aspect of respiratory safety.
- ❖ These regulations often prescribe exposure limits and safety measures that must be followed.
- ❖ Health Surveillance:
 - ❖ Establishing health surveillance programs to monitor the respiratory health of workers over time enables early detection of health issues and facilitates timely medical intervention.

Conclusion:

Mineral dust hazards in the mining industry are a significant concern, with the potential to inflict severe consequences on worker health.

Nevertheless, through rigorous safety measures, education, and a dedication to regulatory compliance, mining operations can significantly reduce the risks associated with dust exposure.

As the mining industry continues to evolve and innovate, it is imperative that it places the respiratory safety of its workers at the forefront, ensuring their well-being in the pursuit of valuable resources.

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Innovation and Future Trends:

Automation:

- Increasing automation in mining operations can reduce the need for human labour in high-dust environments, contributing to enhanced worker safety.

Advances in PPE:

Ongoing research and development are leading to more effective and comfortable respiratory protection equipment, ensuring that miners can work safely and comfortably.



Technical Article-25

JOURNEY OF IRON ORE TO STEEL, ROLE OF LOGISTICS IN MINING AND STEEL INDUSTRY

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Logistics Department, Sanindpur Iron And Bauxite Mines

IRON ORE MINING PROCESS

If we're going to speak that the logistics in the steel industry from start to finish, then we have to go to the origin, which is iron ore. Iron ore are rocks and minerals from which metallic iron can be extracted, so step one in the mining process is to find large iron ore deposits in the earth. When an ore deposit is initially discovered, the ground cover of surface vegetation, soil, and rock material is removed to reach the ore deposits. The overburden is continually removed throughout the iron ore mining process, and this continual cutting creates ore benches that resemble steps in the side of the pits.

DIRECT CUTTING

Iron ore are rocks and minerals from which metallic iron can be extracted so large machine like pocalne or excavator are employed to do this job. Then these materials are transported to nearest Crusher Plant or Screening Plant depends upon the nature of the material.

ROCK BREAKERS

A rock breaker is a machine designed to manipulate large rocks, including reducing large rocks into smaller rocks. They are typically used in the mining industry to remove oversize rocks that are too large or too hard to be reduced in size by a crusher. Rock breakers consist of two major components, a hydraulic hammer (used to break rocks) and a boom (the arm). There are two major types of rock breakers, mobile and stationary - typically placed on a pedestal or slew frame.

BLASTING

As the benches are formed, they become the site for blasting. Machinery is used to drill holes of suitable diameter, depth, and direction for explosives to be placed for what's called "blasting." This is where the process of converting iron to steel begins. Blasting is critical to the iron ore mining process and is used to expose the ore body and break it up for extraction. Blasting must create combustion without an external oxygen supply, and the most common explosives used to do so are a mixture of ammonium nitrate and fuel oil (ANFO).

TRANSPORTATION

Following blasting, the broken ore is ready for transport and loaded onto mine haul roads. Depending on the distance from the open pits to the blast Crusher or screening plants, large dump trucks used to transport the ore materials to the next phase of the iron ore mining process.

CRUSHING PLANTS

Since mined iron ore contains lumps of varied sizes, the biggest being more than 40 inches across and the smallest about 0.04 inches, it typically undergoes a crushing process to prepare it for the blast furnace which can handle lumps 0.27 - 0.98 inches in size. We have the plants like Premier-track 1,2,3,4,5&6 Metro track 21,22&7

SEPARATION BY SCREENING PLANTS

Once crushed, the separation process begins and the iron ore particles are divided into various sections by passing over sieves through which undersized material (or fines) will fall. We at Rungts Mines Limited have various plants like SP horizon 10, 12, 14 etc. SP SANDVIK 2, 3 &6 etc.

IRON ORE BENEFICATION PLANT (IOBP)

This plant is also called as Washing Plant where finished ore is washed to exact to pure form for getting the maximum benefits of the ore. The ore which is collected from this plant is concentrated.

ROLE OF LOGISTICS IN TRANSPORTATION FROM PRODUCTION TO DISPATCH

A Staff from Logistics Department present in the Weigh Bridge helps in feeding the data of Iron ore to various Crushing plants and Screening Plants of trucks where the material was being collected from mines bench.

The finished products like Sc. Fines ,5-18,3-8 ,Conc. Fines Conc. 5-18 etc are stored in various stockyard in central stockyard. These product are now ready to dispatch to various Steel Plants. We at Rungta Sons Pvt. Ltd. have various Steel plants across the nation to meet the needs required by the nation.

ACTIVE ROLE OF LOGISTICS IN TRANSPORTATION OF FINES, CR 5-18,SR 5-18,CONC 3-8,CONC FINES TO VARIOUS STEEL PLANTS.

Initially a permission is taken from Government to lift the desired product like FINES,CR 5-18,SR 5-18,CONC 3-8,CONC FINES etc from stockyard to various steel plants thereby a permit number is generated. Logistics department plays a vital role in this scenario. Logistics shares the permit number, atrial and other important factors to the Weigh bridge operators And the weigh operators smoothly dispatches the materials to various steel plants by arranging necessary documents like Transits pass, GST paper and waybills also other document as required as per Govts. Demand, for verification.

QUICK DISPATCH SYSTEM

This Quick dispatch system helps in transporting materials to various steel plants from stockyard. As soon as trucks enters into weigh bridge a Pocaline machine operator adjusts the material in the truck which may be overweight or underweight. And thereby the weigh bridge operator capture the weight of the materials in I3MS software of Odisha Government site for Government records which the vehicle deems to be fit as per RTO guidelines. For example a 6 wheeler vehicle is allowed to take gross weight of 18500 kg irrespective of its Tare weight.

PROBLEMS WHILE TRANSPORTING THE MATERIALS FROM MINES TO PLANTS

A huge problems arises when the material are being transported from Mines to respective plants being Logistics dept acts as problem solver solves all the problems that comes on the way. A few are

being described below:

The trucks loaded with iron ore are facing underweight and overweight after reaching their destination it is due to rain water mixed while travelling or the material which was being flow away by the wind so the solution was to cover the material with thick plastic cover.

MAKING PELLETS

Finally, the iron ore is made into pellets by combining iron ore with other products to create easily transportable materials. The range of additional ingredients used in pellet-making varies. However, it is not unusual for each pellet to contain some type of clay or limestone and elements such as dolomite and olivine as part of the mix.

THE STEELMAKING PROCESS BEGINS WITH SMELTING IRON ORE

Iron Smelting Now that the iron ore is in pellet form ready for processing, the steel-making process begins. The first step is iron smelting, which is an industrial process used to extract usable iron from raw ore with heat and chemical agents. Iron smelting takes place in a blast furnace for intense heating, along with limestone and coke, and converted to molten iron. The molten iron is then tapped from the bottom of the furnace into molds known as pigs and allowed to solidify into pig iron. After smelting, the iron can be further processed and alloyed with other materials to produce steel. Here are some of the different methods of steel production.

SHAPING STEEL

Steel Shaping Before steel transport and use can happen, the steel needs shaping. Several different methods for shaping steel are available in steel making, and they largely depend on the desired steel application.

ROLL FORMING

Roll forming involves gradually bending flat sheet metal into a long, uniform shape by passing it through a series of tool dies. It is highly economical for mass production of angles, channels, long components with holes, and complex shapes with multiple bends

EXTRUSION

Extrusion is a process in which metal is confined in a closed cavity and then allowed to flow through only one opening so that the metal takes the form of the opening, much like squeezing toothpaste out of a tube

PRESS BRAKING

When a piece of sheet metal is formed along a straight axis, this is press braking. This process can be accomplished by a v-shaped, u-shaped, or channel-shaped punch and die set. Although press braking appears to be a simple concept, maintaining accuracy can often be quite difficult.

STAMPING

Metal stamping converts flat metal sheets into specific shapes or cuts out a piece of metal. This complex process can include several metal forming techniques, such as blanking, punching, bending, or piercing.

FORGING

Steel forging shapes metal using localized compressive forces, or blows, delivered with a hammer or a die. The temperature at which it is performed determines the classification: cold forging, warm forging, or hot forging. Forged steel is commonly used to create:

CASTING

Steel casting involves pouring liquid metal into a mold that contains a hollow cavity of the desired shape. These items are typically made with forged steel:

STEEL TRANSPORT

Steel Transportation Steel is commonly transported using trucks, trains, or ships. The type of transportation used will depend on the size and amount of steel in transport and the distance it must be transported. The transportation process requires extreme care and precision, as steel is heavy and can cause accidents and mishaps if not appropriately handled.

ORGANIZING STEEL STOCK & STORAGE

Steel Organization Steel stock is stored in different classes, sizes, and lengths. It should be stored above ground level on platforms, skids, or any other suitable supports to avoid distortion of sections. In coastal areas or cases of extended storage, it's good practice to apply a protective coating of primer to prevent scaling and rusting. We at Rungta Family have a highly knowledgeable staff to help you navigate our extensive steel stock, making it easy to acquire even hard-to-find items. We are committed to ensuring smooth transactions and make it easy and quick for you to find what you need, purchase it, and load it.

Technical Article-26

JOURNEY OF IRON ORE TO STEEL ROLE OF LOGISTICS IN MINING AND STEEL INDUSTRY

"Rockfall Hazards Assessment and Safety Measures in Open Pit Mining."

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Abstract:

Open pit mining, a vital component of the mining industry, brings with it the persistent threat of rockfall hazards. This paper explores the critical aspects of rockfall hazard assessment and the imperative safety measures to safeguard workers and mining operations.

The foundation of effective rockfall hazard management lies in geological assessments and continuous monitoring. Geological surveys identify high-risk areas, while geotechnical instruments provide real-time data for early detection. Historical data offers invaluable lessons for risk mitigation. Safety measures include rock scaling to systematically remove potential hazards, catch fences and barriers to intercept falling rocks, and slope stabilization techniques. Proper bench design further reduces the risk of rockfalls. Worker safety is paramount, necessitating the provision of Personal Protective Equipment (PPE) and comprehensive training programs. Restricted access zones, safety

equipment, and effective communication are essential, as are comprehensive emergency response plans for rockfall incidents. Adhering to local regulations and industry standards is crucial to maintain a secure working environment. In this era of advancing technology, integrating modern monitoring and safety measures with traditional practices enhances the safety and efficiency of open pit mining operations.

INTRODUCTION:

Open pit mining, a cornerstone of the global mining industry, offers access to essential resources but also presents a formidable challenge - the threat of rockfall hazards.

These hazards can result in injuries, damage to equipment, and operational disruptions.

This article delves into the critical aspects of assessing and mitigating these hazards, we'll explore the assessment of rockfall hazards and the safety measures that must be implemented to protect the well-being of workers and the efficiency of mining operations.

Highlighting the vital safety measures that ensure the well-being of workers and the uninterrupted flow of mining operations.

Understanding Rockfall Hazards:

At the heart of rockfall hazard management is a comprehensive understanding of the geological



characteristics of the mining site.

Geological Assessment:

- ❖ The initial step in mitigating rockfall hazards involves a thorough geological survey of the pit.
- ❖ This survey helps identify potential rock fall risks by examining rock types, structures, and instability indicators.
- ❖ This investigation scrutinizes the rock types, geological structures, and potential instability indicators. It is a foundational assessment that forms the basis for risk evaluation.

Monitoring Systems:

- ❖ Employ geotechnical instruments like inclinometers and seismometers to continuously monitor rock movements. Early detection can be critical in preventing accidents.
- ❖ Slope stability radars is essential. These devices provide real-time data on rock movement, allowing for early detection and response to unstable conditions.

Historical Data/ Learning from Experience:

- ❖ Reviewing past incidents and near-misses can reveal high-risk areas and inform safety strategies.
- ❖ It can provide valuable insights into high-risk areas and informing the risk reduction strategies.
- ❖ These lessons from the past are invaluable for preventing future incidents.

Safety Measures:

Safety measures for rockfall hazards are essential to protect workers and equipment in areas prone to falling rocks. Here are some key safety measures.

Rock Scaling:

- ❖ The removal of loose or overhanging rocks is a vital safety measure.
- ❖ This process, known as scaling, employs scaling bars, wire saws, or controlled explosive methods to clear potential hazards systematically.

Catch Fences and Barriers:

- ❖ The installation of catch fences, mesh barriers, or other physical structures at strategic locations serves to intercept and contain falling rocks.
- ❖ These barriers protect workers and equipment from the dangers of rockfall.

Slope Stabilization:

- ❖ To secure unstable rock faces and reduce the likelihood of rockfalls, open pit mining operations employ slope stabilization techniques.
- ❖ These may include rock bolting, meshing, and shot creating.

Benching:

- ❖ Proper bench design with appropriate angles is essential in minimizing the potential for rockfalls.
- ❖ A well-structured bench layout enhances safety within the mining pit.

Prioritizing Worker Safety:

Personal Protective Equipment (PPE):

- ❖ Workers must be equipped with the necessary personal protective equipment, including helmets to safeguard against head injuries, high-visibility clothing to ensure visibility, and steel-toed boots to protect their feet.

Training and Education:

- ❖ A culture of safety is cultivated through comprehensive training programs that educate workers on rockfall hazards, safe work practices, and emergency response procedures.
- ❖ Regular safety drills bolster preparedness.

Restricted Access Zones:

- ❖ High-risk areas are often designated as restricted access zones, marked with warning signs and physical barriers to prevent unauthorized entry.

Safety Equipment:

- ❖ Mining sites install specialized rockfall protection systems, such as rockfall sheds or embankments, to shield critical infrastructure and work areas from falling rocks.

Effective Communication:

- ❖ An efficient communication system is pivotal for workers to report hazards and emergencies

swiftly.

- ❖ It establishes clear channels of communication to ensure a prompt response.

Emergency Response Plans:

- ❖ Mining operations must develop comprehensive emergency response plans for rockfall incidents.
- ❖ These plans encompass evacuation procedures, first aid training, and the availability of communication devices and medical supplies.

ROCKFALL HAZARDS SIGNS:

Rockfall hazard sign boards are important for several reasons:

- ❖ **Safety:** They alert people to the potential danger of falling rocks in a specific area, helping them take precautions and avoid hazardous areas.
- ❖ **Risk Mitigation:** These signs are crucial for reducing the risk of accidents, injuries, or even fatalities caused by rockfalls.
- ❖ **Awareness:** They raise awareness about natural hazards, helping people make informed decisions about where to hike, build, or engage in recreational activities.
- ❖ **Liability:** In some cases, property owners or land managers may be legally required to post rockfall hazard signs to reduce liability in the event of accidents.
- ❖ **Property Protection:** For property owners, these signs can help protect their assets from potential damage caused by rockfalls.



Conclusions:

Rockfall hazards are a prevalent and concerning aspect of open pit mining. The geological conditions that make mining viable are, paradoxically, the same conditions that pose the risk of falling rocks. However, through diligent rockfall hazard assessment and the implementation of safety measures, the industry can significantly reduce these risks.

Adhering to local mining regulations and industry standards is paramount to maintain a secure working environment.

With the amalgamation of preventive measures, worker training, and emergency preparedness, open pit mining can continue to thrive, supplying the world with valuable resources while ensuring the safety and well-being of its workforce.

In this age of advancing technology, there is an increasing opportunity to employ state-of-the-art monitoring and safety measures, which, when coupled with the traditional practices discussed in this essay, contribute to a safer and more efficient open pit mining industry.

Technical Article-27

SLOPE STABILITY IN OPEN CASTMINE

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SLOPE STABILITY IN OPEN CAST MINE (SOIL NAILING METHOD)

ABSTRACT

Slope in open cast mines undergoes many considerations like loose soil slopes, low rock mass strength, water pressure, high water table, pore pressure within the soil, steepness of slopes, fractures etc., for improve the stability of slopes we adopt engineering techniques. Those techniques aim to increase the stability.

DEFINITION

Soil nailing is a remedial construction measure to treat unstable natural soil slope or unstable man-made slopes as construction technique that allows the safe over steepening of new or existing soil slopes.

APPLICATIONS

- ❖ It is used to reinforce and stabilize the slope of soil and retaining walls.
- ❖ Soil nailing is done for widening roadways, railway embankment, landslides, and floor protection on the bank of rivers, highway embankment, cutting etc.
- ❖ It is used for retrofitting and construction the bridge abutments.

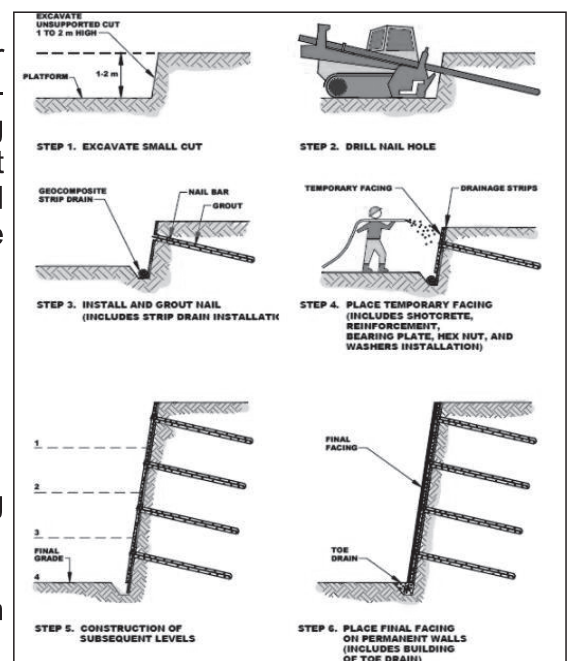
LITERATURE AND PREVIEW

The technique involves the inserting of relatively slender reinforcing element in slopes. Solid bars installed in per-drilled holes on slope. Solid bars installed using drilling technique are usually fully grouted and installed at a slight downward inclination with bars installed at regular spaced points across the slope face. Alternatively, a flexible reinforcing mesh be held against the soil face.

INTRODUCTION

Soil Nailing technique process:

- ❖ Excavation for installing the nail ground surface.
- ❖ Drilling is done for designed cut heights.
- ❖ Nails are driven into drilled holes.
- ❖ Bond is made between nail ground using grouting material.
- ❖ Installation of soil nail head plate.
- ❖ The construction phase of shotcrete on soil nail face with wire mesh or reinforcement if required.



Types of soil nailing methods

I. Drilling and grouted soil nailing method:

- In this method, in naturally or excavated slope face
- With help of drilling machine holes are made
- Nails are inserted in these drilled holes with grouting materials concrete or shotcrete in the spacing interval of 1.5m using (100-200mm) diameter nails.
- The reinforcement for temporary facing wire mesh shall be placed.

II. Driven soil nailing method

III. Self-drilling soil nail method

IV. Jet grouted soil nailing method

V. Launched soil nailing method.



(Figure-01 : Drilling)



(Figure-02 : Nail installation)

MACHINERY USED FOR SOIL NAILING

- I. Rotary machine with a downhole hammer.
- II. Air compressor
- III. Grout mixer
- IV. Grout pump (for shotcrete)

METHODOLOGY

ANALYSIS

The soil should be able to stand unsupported one to two meters high for a minimum of two days when cut vertical or nearly vertical and all soil nails within a cross section should be located above the groundwater table.

1. For considering soil nailing first, the existing ground should be examined.
2. Advantages and disadvantages for a soil nail wall should be assessed for the particular application being considered.
3. Cost of the soil nail should be considered.

COMPONENTS

SOIL NAIL: This component includes tendon, grout, and corrosion -proof soil nail.

Tendon: Tendon is a ground-reinforcing element like a steel (hollow or solid) bar that is inserted behind a soil nail wall.

Grout: Grout is used for transforming the shear and tensile stresses from tendon to the ground to increase the stability. Portland cement and water are used to be placed in drilling holes under gravity by using the tremie method.

Corrosion Proof: For long-lasting, the soil nail should be protected against corrosion.

To protect the soil nail from corrosion, it is encapsulated by a sheath of a fusion- bonded epoxy coating or galvanization.

1. OTHER COMPONENTS:

Other components like nut, bolts, washers, bearing plates, and headed studs are embedded with soil nails. There should be proper drainage system around soil nailing site using ground anchors, geosynthetic material, and so on.

Types of soil nailing methods

1. Drilling and grouted soil nailing method:

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- f) Nails are inserted in these drilled holes with grouting materials concrete or shotcrete in the spacing interval of 1.5m using (100-200mm) diameter nails.
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2. Driven soil nailing method

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5. Launched soil nailing method.

ADVANTAGES

1. Shotcrete facing is economical.
2. Cost-effective method for durability and stability of slope soil failure.
3. It can be applied for relatively large area.
4. It is suitable for various application like temporary excavation shoring, tunnel portals, repairing of failure structures, etc.
5. Installation process takes less time.
6. It has less impact on the environmental system.
7. It uses fewer materials and machinery.
8. It has no height limitations.

DISADVANTAGES

1. Unsuitable for high water table areas.

Technical Article-28

SALVATION

Dr. Aatish Mishra, Medical Officer, OMC Ltd.

In the heart of a small mining city, nestled deep inside the rugged mountains, there lived a close-knit network of miners. These hardworking women and men relied on this mine for his or her livelihoods, but they also understood the risks that came with the activity. Safety became their pinnacle priority, and they took it very seriously.

The mine managed by an experienced manager named Pankaj. Pankaj had spent his entire life inside the mining industry, and he knew that protection turned into paramount. He made it a factor to behavior regular protection meetings and drills for the miners. In those meetings, he emphasized the significance of checking equipment, proper ventilation, and maintaining clean conversation between the miners under and those above. One crisp morning, because the solar painted the sky in hues of orange and red, the miners collected on the mine's entrance for his or her every day shift. Pankaj addressed the institution, "Remember, all of us, we have to preserve our protection at the leading edge of our minds. Today, we'll be exploring a brand new section of the mine, so I need you all to be extra cautious."

As they descended into the depths of the earth, every miner diligently checked their gadget, making sure helmets were secure and headlamps operating well. They ventured into the brand new segment, conscious that uncharted territory delivered new challenges. The mine changed into dark, and the sound in their pickaxes echoed through the tunnels.

Hours handed, and that they made development. But all of sudden, there was a rumble, and the floor underneath their toes trembled. Panic set in as dust and rocks fell from the ceiling. The miners' schooling kicked in. They retreated to the closest secure sector while retaining conversation with those above. Pankaj ensured every person became accounted for and secure.

Above floor, the alarm were sounded, and the mine's emergency response crew swung into action. Rescuers donned their tools and rushed to the scene, even as others monitored air great and communique.

After a anxious wait, the rescue group reached the trapped miners. Through a small commencing, they added meals, water, and plenty-wished reassurance. The miners favored the education that had prepared them for such an occasion, and that they remained remarkably calm.

With wonderful care and precision, the rescue team stabilized the region and labored tirelessly to unfastened the trapped miners. It become a grueling effort that took several days, however their dedication by no means wavered.

Finally, after what seemed like an eternity, the rescue crew succeeded in releasing the miners. As they emerged from the dark depths, their faces were etched with gratitude for the safety measures in vicinity and the tireless efforts in their colleagues.

This incident served as a stark reminder of the importance of mine protection. The entire community rallied around the miners, reinforcing their commitment to looking out for one another. The city invested in state-of-the-art protection equipment and ensured that ordinary protection training continued.

The mining city learned that protection changed into no longer simply a hard and fast of regulations however a way of existence. They knew that the only manner to thrive in the world of mining turned into to make certain every miner again domestic to their households, safe and sound, on the stop of every day.

Technical Article-29

The Important of Sustainability in Electrical Industry

Sri Girija Shankar Satapathy
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Sustainability is about doing better in a continual approach.

When we incorporate the most effective social, environmental, technical initiatives in our day-to-day approach, it opens roads to new opportunities to save the planet not only by making it more green, resources conservation, efficient energy utilisation & conservation etc. but also, in many many more ways.

It's a journey, and every small step counts towards creating a better future for generations to come.

Sustainability is vital in the electrical industry, where environmental impact and energy efficiency are key concerns.

This includes.

- Sustainable practices,
- Promoting energy efficiency,
- Integrating renewable energy,
- Adopting a life cycle approach, etc.

The electrical industry is undergoing a transformative shift towards sustainability, recognizing the crucial role it plays in shaping a greener future. As concerns about climate change and resource depletion intensify, embracing sustainable practices in the electrical industry has become more important than ever. There is significant impact of sustainability in the electrical industry for a more environmentally conscious and efficient future.

Environmental Conservation:

Sustainability in the electrical industry revolves around minimizing its environmental impact. By adopting sustainable manufacturing processes, optimizing energy usage, and reducing carbon emissions, it can contribute to preserving our planet's resources. Embracing sustainable practices not only safeguards the environment but also enhances the industry's reputation as a responsible and eco-friendly sector.

Energy Efficiency:

Energy efficiency is a key pillar of sustainability in the electrical industry. As energy demand continues to rise, it becomes crucial to optimize energy consumption.

The uses of energy-efficient electrical equipment, such as motors, transformers, and switchboards, to significantly reduce energy waste and greenhouse gas emissions. The energy-efficient solutions not only benefit the environment but also lead to substantial cost savings for consumers and businesses alike.

Renewable Energy Integration:

It is the renewable energy revolution in the electrical industry. By embracing and promoting the integration of renewable energy sources, such as solar and wind power, we accelerate the transition away from fossil fuels. This integration not only reduces dependence on finite resources but also contributes to a cleaner energy mix. The research and development initiatives require to further solidify to sustainability in this regard.

Smart Grids and Energy Management:

Advancements in technology have paved the way for smarter electrical grids and energy management systems. The smart grid solutions provide enhance energy efficiency, reduce power losses, and facilitate the integration of renewable energy sources.

Lifecycle Approach:

Sustainability in the electrical industry extends beyond manufacturing. Lifecycle approach has to be adopted by considering the environmental impact of products throughout their entire lifespan, from production to disposal.

It must be emphasized responsible usage, maintenance, repair, and recycling of electrical equipment

to reduce waste and minimize environmental harm.

Sustainability in Electrical System

Sustainability is not a choice but a necessity for the electrical industry. By prioritizing sustainability, companies have the power to make a significant impact. Embracing sustainable practices enables them to contribute to environmental conservation, drive energy efficiency, integrate renewable energy, adopt a lifecycle approach etc.

Not only does this benefit the environment, but it also enhances the industry's competitiveness, reputation, and resilience. The power of sustainability in the electrical industry lies in its ability to shape a cleaner, more efficient, and sustainable future for generations to come.

On this journey, every small step counts towards creating a better world for us and future generations. The Energy audit is also a key tool, to find out means of energy saving.

We must focus on sustainability efforts-and we must continue to push forward to promote the advantages of more intelligent electrical systems, as they have the potential to significantly reduce energy consumption and cost through data collection that ultimately benefits the system and the environment.

Some of the tools we may go for

- Uses of Energy efficient equipment.
- Conducting Energy Audit.
- Implementation of latest knowhow system approach to study the consumption Pattern.
- Administrative controls.
- Awareness development within the inmates.
- Maintaining the data
- Analysing the data in line with continual improvement.
- Maintaining that achieved level with an intention of achieving the next level.
- Ensuring the economical feasibility along with its pay back period.
- More use of Automated systems. etc.

Digitisation

When it comes to saving on cost and energy, data is key.

The next generation of products will be focused on leveraging automation and artificial intelligence to learn about a system's total energy pattern.

The most important points to gather the data on consumption, as these will help to ascertain energy consumption on equipment wise, building wise etc., enabling to plan further.

Installing intelligent, connected, data-rich networks that can identify patterns and adjust accordingly are ultimately our greatest asset when it comes to saving time, energy, and the planet.

Commitment

All corporates should have a sustainable approach with a commitment taking various related factors into account like

Resource conservation: Preserving valuable resources through responsible and efficient management.

Energy efficiency : Optimizing energy use to minimize waste and environmental impact.

Habitat Protection : Safeguarding ecosystems and natural habitats for biodiversity and balance

Local community enrichment: Empowering and enhancing the well-being of communities in our operational areas.

Approach

Nothing can be achieved within a night. We must put our effort to achieve the steps of sustainability. Achieving a step-in sustainability may be tough but to maintain that level of sustainability eyeing the next level is more tough.

Hence the sustainability system must be a process approach instead of person approach.

Technical Article-30

Embracing the Digital Revolution: The Power and Impact of Digitization

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JSP, TENSA, HEMM Deptt.

Introduction

Digitalisation is one of the most important and transformative forces which are playing a central role in an evolving 21st century landscape. From our way of working and communicating with one another to how we access information and conduct business, this technological revolution is affecting all aspects of our lives. Digitization has great capacity for transforming industries, increasing efficiency and enhancing our everyday experience in ways that are never before possible.

Defining Digitization

Digitization, at its core, involves the conversion of analogue data into Digital Data Formats. This includes the representation of data, images, sounds, and documents as binary codes that can be easily stored, processed, and transmitted by electronic devices. A multitude of innovations have been developed in the digital era, which has resulted in an extensive impact on a number of sectors and industries.

The Impact on Communication

The impact of digitization on communication is one of the biggest immediate and lasting effects. From all corners of the globe, people are able to communicate in real time because of the advent of the internet, social media and Instant Messaging Platforms. This is not only changing the way we keep in touch with friends and family but it's also creating a new level of business communication. In addition, companies are able to connect with a global audience by means of websites, internet marketing campaigns and e-shop platforms.

Transforming Information Access

Digitisation makes it possible to access information more easily. Substantial digitisation efforts have been launched by Library, Archives and Museums in order to allow their collections to be made available on the Internet. This digital knowledge is accessible at our fingertips, making it possible for students, researchers and enthusiasts to explore a treasure chest of information that promotes innovation and education. Digitization has changed our way of getting information in the field of news and media.

Online news sources, podcasts, and streaming services have supplemented (and in some cases replaced) conventional newspapers and television. This change has accelerated and broadened news dissemination while also fostering citizen journalism.

The Digital Workplace

Digitisation, with more and more of its work being carried out by remote workers, has also changed the workplace. This trend has been prolonged by the pandemic of COVID19, which forced companies to rapidly adjust to work environments away from their normal offices and embrace digital collaboration tools. A better balance between work and life may be achieved through the flexibility of remote working, making it possible to access a worldwide talent pool.

In addition, different sectors are being revolutionized by new technologies such as automation and AI that enhance efficiency; reducing the need to carry out a repetitive set of tasks. This may lead to concerns of job losses, but it also gives rise to more creative and fulfilling jobs in the workforce.

Enhancing Healthcare

Digitalisation has improved patient care, diagnosis and treatment in the field of healthcare. In order to improve the coordination of care, information on patients has been simplified and errors have been reduced through EHRs. Telemedicine has enabled patients, especially in times of crises such as the COVID19 epidemic, to benefit from expert medical advice and services remotely. Patients are able to monitor their condition in real time through medical devices and wearables.

Challenges and Considerations

The benefits of digitization are great, but they also raise a number of challenges. Urgent concerns

have arisen in relation to cybersecurity and data protection. The risk of cyberattacks and data leaks will increase as more information is digitised and stored in the cloud. It is of fundamental importance to ensure the safety and security of Digital Information.

Moreover, the digital divide continues to be a serious problem. While digitization is accessible to a large number of people, there are still inequalities on access to technologies and the skills needed for managing this new world. Ensuring the benefits of digitalisation for all is crucial to bridging this divide.

Conclusion

Our world is changing as a result of digitization, which is a strong force. It has altered how we communicate, acquire information, and engage in our daily act technical environment. As we advance, it is critical to address the issues with digitization, such as cybersecurity and the digital divide, and to realize its full potential for societal benefit. By embracing the digital world, which is here to stay, we may open up new possibilities and inventions that will influence our future. ivities. In order to embrace the digital revolution, one must have a thorough grasp of its implications and the flexibility to change with the quickly changing.

SAFETY SLOGAN-01

Raju Mandal
Mine-Thakurani Iron Ore Mines, M/S AMNS Ltd.

1. "Safety Is Not a Slogan It's a Way of Life "
2. "Don't Be Safety Blinded, Be Safety Minded"
3. " Safety First, Injuries Last"
4. " Safety Is Gainful, Accident Is Painful".
5. "Safety Mean: Seek Safety, Aim Safety, Follow Safety, Ensure Safety, Teach Safety, Yield Safety".
6. " Safety First, Production Must "

SAFETY SLOGAN-02

Safety Anyway

Patnala Chandra Sekhar
Logistics Department, Sanindpur Iron And Bauxite Mine

Falling objects says I will damage your Head
But Safety Helmet says I will protect your head Anyway.....

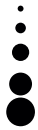
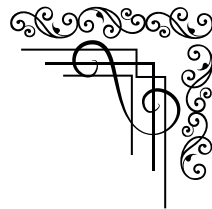
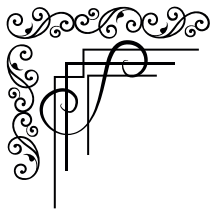
Welding Torch says I will damage your Eyes
But Safety Goggles Says I will protect your eyes Anyway.....

Potentially infectious materials or contaminated surfaces says i will damage your Hands
But safety Gloves says I will Protect your Hands Anyway.....

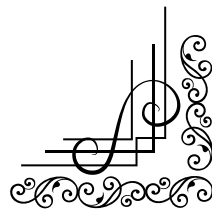
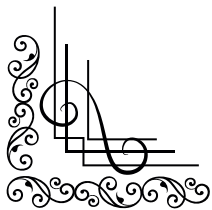
Harmful dusts, mists, fumes and gases says i will damage your lungs
But safety Masks says I will Protect your Lungs Anyway.....

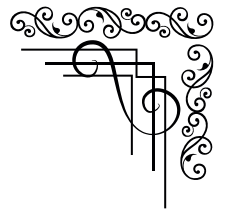
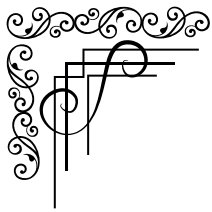
Excessive noise pollution, dust or temperature variations says i will damage your ears
But safety Earmuff and Earplug says I will protect your Ears Anyway.....

Falling objects, hot surfaces and electrical shock says I will damage your Legs
But Safety Footwear says I will protect your Legs Anyway.....



हिन्दी विभाग





सुरक्षा आह्वान

खबर पहुंची घर में जौसे तैसे,
नकाम आई वह जेब के पैसे,
पत्नी बेटी दौड़ी आई
आखों में आंसू की भौछार थी आई।
खून में बहता मैं हैरान था
अगर मेरे साथ इतना कुछ होगया,
तो मैं खुद को देख कैसे पा रहा था ?
लगता है मैं सपने में परीशान था।
जब मैं ने अपनी आँखों को जोर से से हिलाया
खुद को बिस्तर पर देख बेटी ने मुझे समझाया,
देख रहे थे एक भयानक सपना
चीख फाड़ रहे थे गला आपना
इनखाबों के खाब ने
बहुत कुछ मुझे सिखाया
सड़क सुरक्षा जीवन का अर्थ है,
इसके बिना जीना व्यर्थ है।
याद रखें नसीब बचाये एक बार
शुरक्षा बचाये हर बार

Chayan Das
Area Manager
M/s Tata Steel Limited.

खदान सुरक्षा

सुरक्षा का ध्यान रखे, खदानों में जाने,
जीवन की रक्षा करो, खुद को बचाने।
कभी अलसाना मत, संबेदना बर तो,
खदान की गहराईयों से, सुरक्षित लौटो।
काम से पहले उपकरणों को नयिमित परखो,
खतरे को पहचानो, और दूरसे नजर रखो।
मास्क पहनो, और धूलरो को अपने द्वार,
लंबी उम्रजी यो, रखो फेफड़ों को तैयार।
शुरक्षा के नियमों का पालन हमेशा करे,
सुरक्षा से अपनी जीवन में खुशियां भरो।
सावधानी और सुरक्षा, खदान की शान है,
सदैव याद रखो, खुद को बचाने में मान है।
खदान के अंदर, जीवन की राह,
सुरक्षित रहें हम, यहाँ है हमारा चाह।
हेलमेट पहनो, और गर्दन पर ताला,
खदान की आँखों में चमके सबका प्यारा।
खदानों में सुरक्षा, हमारी जिम्मेदारी,
सबके लिए सुरक्षित, हो यही प्रार्थना हमारी।

Pabitra Kumar Biswal
Junior Executive Assistant
Kurmitar Iron ore Mines, OMC Ltd.

सुरक्षा नियमों का तुम पालन करना,
खदानों में जरा संभल कर चलना।
माना खदान में कार्य करना है बहुत जरूरी,
मगर कार्य आरंभ करने से पूर्व,
खुदकी सुरक्षा जांच हैं जरूरी।
हेलमेट और सेफ्टी जुते पहन कर जाना,
अपने आपको छोटी हो या बड़ी,
हर हादसों से बचना।
ऊंची हाइट पर जब भी कोई कार्य करना,
सुरक्षा हार्नेस बेल्ट लगाकर
खुदको सुरक्षित रखना।
खदानों में जरा वाहन तु धीमे चलाना,
हर चिन्ह तबाहन नियमों का तु पालन करना।
खदानों में कार्य करते समय कर्णपट्टिका पहने रखना,
कानों को तीव्र ध्वनि से सदैव बचाएं रखना।
खदानों में फोन पर कभी बातें ना करना,
छह दिशात्मक खतरों से खुद को सुरक्षित रखना।
खदानों में लापरवाही बरतने से दूरी बनाए रखना,
खदान सुरक्षा नियमों का तुम अनुपालन करना।
यह सुरक्षा नियम हर ब्यक्ति को हैं समझाना,
खदान में कार्य करने के बाद
सुरक्षित होकर घरको जाना।
सुरक्षित होकर हर काम करना,
अपने परिवार की खुशियों का तुम ध्यान रखना।
सुरक्षित खदान, सुरक्षित परिवार
इसमे बनेगा हमारा देश खुशहाल।।

Alok Singh Sardar
Bamebari Iron & Manganese Mine
M/s Tata Steel Limited

Mines Safety Slogan

सुरक्षा कर्तव्य है हमारा,
सुरक्षित हो हर कार्य हमारा,
इस से सुरक्षित होगा परिवार सारा,
हर कार्य को पहले जानो,
सुरक्षा के हर मापदंड को पहचानो,
बिना जाने ना करो कोई काम,
इस में अपने कारखाने में हो सकता है नुकसान,
अपने कार्य को हरदम करो समीक्षा,
सुरक्षा से कार्य करने पर प्रवल होगी इच्छा,
हमे लेना होगा संकल्प,
सेफ्टी का कोई नहीं है दुसरा कोई विकल्प,
सुरक्षित हो कर सारे कार्य कर्तव्य हमारा,
प्रोदंकरन के साथ, सेफ्टी के हर नियम का
पालना कर्तव्य है हमारा।

Kaustav Guha, Area Manager
Khondbond Iron & Manganese Mine
M/s Tata Steel Limitrd.

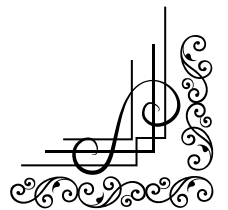
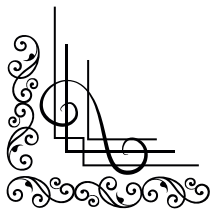
शुरक्षा का महत्व
सुरक्षा से समझौता
न तुम करना भी,
सुरक्षा के दायरे में ही
रहना है सही।।
हेलमेट, जैकेट, सेफ्टी बूट्स से
करलो तुम तगडी यारी,
नसमझना इसे कभी बोझ,
बनालो इसे अपनी जिम्मेदारी।।
करना तुम पालन हमेशा
सुरक्षा-नियमोंका, कियुकी
तेरे सुरक्षित जीवन का।।
अपनी सुरक्षा का खुद ही
रखना तुम ध्यान,
कियुकी तुझमे बसती है
तेरे परिवार की जान।।

Suman Munda
Kurmitar Mines, M/s OMC

Poem for Safety

सुरक्षा है जरूरी,
हर जगह, हर समय।
घर, स्कूल, ऑफिस, सड़क, माईस
सुरक्षित रहो, हर कदम।
सुरक्षा के नियमों का पालन करो,
सावधानी बरतो, हर काम में।
जोखिम न उठाओ,
अपनी जान को खतरे में मत डालो।
सुरक्षा ही जीवन है,
इसलिए सुरक्षित रहो,
सुरक्षित रहो।

Soumya Ranjan Das
Logistica Thakurani Iron Ore
(AM/NS, India)



सुरक्षा संकल्प

सुरक्षा ही है हमारी पहचान,
हर कदम पर हो, सुरक्षा का ज्ञान ।।
सुरक्षा से जुड़ा हर कदम हो साबधान,
संबेदनशीलता के साथ,
सुरक्षा को करे सम्मान ।।
सुरक्षा का संदेशा फैलाएं,
हर दिन सुरक्षा को बढ़ावा दें ।
दुर्घटना से बचाव है हमारा मंत्र,
सुरक्षा ही है हमारी
नई शुरुआत का बंधन ।।
हर काम में सुरक्षा का ध्यान रखें,
हर समय सुस्त: सुरक्षित रहें ।
सुरक्षा को महत्व दें,
जीवन को खुशहाल बनाएं ।।
प्रकृति को नुकसान नहीं पहुंचाओ,
खनन में सुरक्षा, संरक्षण हो जीनेका सहारा ।
समुद्रों से ज्यादा मुल्यवान है
सुरक्षाका खजाना,
विकास करे सुरक्षित तब होगा
सुस्ती का आनंद ।।
खनन में सुरक्षा सबसे महत्वपूर्ण,
शून्य हादसों का हो यही हमारा उद्देश्य ।
कठिनाई यों से भरा यह काम,
सुरक्षित से भरपुर हो हमारा अभियान ।।
सुरक्षा सबसे पहले, यही हमारा नारा,
हर काम में जगह बनाए,
सुरक्षा का आदाना ।
जीवन की कठिनाई यों में,
हो सुरक्षित हमेशा,
सुरक्षा है वो मंत्र, जो करता है
हर काम को सरल ।।
सुरक्षा का है वचन, सबसे पहले यही है निर्णय,
हर काम में सुरक्षितता,
बनाए रखना हमारी प्रथमिकता ।
सुरक्षाका प्रतिज्ञा है हमारा संकल्प,
हर दिन, हर पल, बनाएंगे
सुरक्षितता का गुलजार ।।

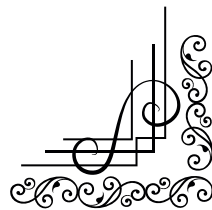
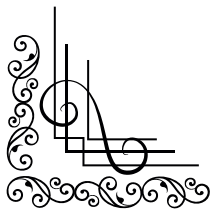
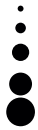
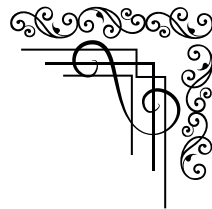
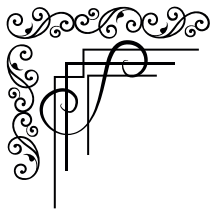
Raghunath Sahoo
Ostapal Chromite Mine
Vedanta FACOR Ltd.

Slogan for Safety Week

Zero Accidents,
Zero Excuses
Safety:
Your Responsibility,
Our Priority.
Safety:
It's in Your Hands
सुरक्षा सप्ताह मनाओ, जीवन को
सुरक्षित बनाओ ।
सुरक्षा पर हो निरंतर ध्यान, सुरक्षा
सप्ताह का मनायें सम्मान ।

ନିଜ ସୁରକ୍ଷା, ଭବିଷ୍ୟତର ରକ୍ଷା ।

Soumya Ranjan Das
Logistica Thakurani Iron Ore
(AM/NS, India)



ଓଡ଼ିଆ ବିଭାଗ

ସ୍ବାସ୍ଥ୍ୟ ସୁରକ୍ଷା

ସ୍ବାସ୍ଥ୍ୟ ର ସୁରକ୍ଷା
ତାକୁ ନ କର ଅଣଦେଖା
ସ୍ବାସ୍ଥ୍ୟ ଥିଲେ ମିଳେ ଶାନ୍ତି
ସ୍ବାସ୍ଥ୍ୟ ର ଅବହେଳା ବୁଝୁ
ବୁଝାଇବ ଭେଳା

Ajit Mohan Acharya
Khondbond Iron & Mn Mine
M/s Tata Steel Ltd.

ସ୍ବାସ୍ଥ୍ୟ ସୁରକ୍ଷା

ସ୍ବାସ୍ଥ୍ୟ ଆମଏକ ଅମୂଲ୍ୟ ସମ୍ପଦ
ରଖିବା ସୁରକ୍ଷା ଦେଇ,
ସବଳ ସ୍ବାସ୍ଥ୍ୟଟି ଆମପାଇଁ ଲୋଡ଼ା
ଜିଇଥିବାଯାଏ ରହି ॥୧॥
ସୁସ୍ଥମ ଖାଦ୍ୟକୁ ପ୍ରାଧାନ୍ୟତା ଦେବା
ଶରୀର ପୋଷଣ ପାଇଁ,
ସ୍ବାସ୍ଥ୍ୟ ଏକସିନା ଅମୂଲ୍ୟ ସମ୍ପଦ
ହୁଡ଼ିଲେ ପାଇବା ନାହିଁ ॥୨॥
ମଦ, ଧୂମପାନ, ତମାଖୁ ସେବନ
ନେନବା ତାକୁରେ ଭାଇ,
ନ' ମାନି ତଳିଲେ ଯମର ଭେଟତ
ସ୍ବାସ୍ଥ୍ୟକୁ ଦେବା ହରାଇ ॥୩॥
କଳକାରଖାନା ଖଣିଖାଦନକୁ
ରଖିବା ସୁହତା ଦେଇ,
ସେବଳେ ଏହାକୁ ସାଇତି ରଖିଲେ
ରହିବା ନିରେଶ ହୋଇ ॥୪॥
ଧରଣୀ ରାଣୀକୁ ସବୁଜିମାସାଜି
ରଖିବା ଯତନେ ଭାଇ,
ସୁସ୍ଥ ଜଳବାୟୁ ପାଇବା ସେଥିରୁ
ରହିବା ଦାୟାୟୁ ହୋଇ ॥୫॥
ସୁସ୍ଥ ଶରୀରଟି ଗଢ଼ିବାକୁ ହେଲେ
ଯୋଗାଭ୍ୟାସ ଆମଲୋଡ଼ା,
ପ୍ରଫୁଲ୍ଲ ରହିବ ମନଟି ଆମର
କାର୍ଯ୍ୟ ଦିବସରେ ଭରା ॥୬॥
ଯେ-ଯାହା କାର୍ଯ୍ୟରେ ନିଯୋଜିତ ଥିଲେ
ସୁରକ୍ଷାକୁ ଧ୍ୟାନ ଦେବା,
ସୁରକ୍ଷା ବଳୟେ ରହିଲେ ଆମକୁ
ସୁସ୍ଥ ହୋଇରହିଥିବା ॥୭॥
ଏହି ଉପଦେଶ ମାନିକି ତଳିବା
ଜାଗ୍ରତ ହୋଇବା ରହି,
ଡାକ୍ତର ବଜ୍ର ପାସେମାଡ଼ିବାନି
ସୁସ୍ଥଥିବା ଯେବେ ରହି ॥୮॥

ଶ୍ରୀ ଦିଲ୍ଲୀପ୍ କୁମାର ନାୟକ
ବାଦାମ ପାହାଡ଼ ଲୌହଖଣି
(ଏମ୍.ଏସ୍.ଜି.ଏମ୍. ଆଇରନ୍ ଏଣ୍ଡ ଷ୍ଟିଲ୍ କୋ:ଲିଡ଼)

ସ୍ବାସ୍ଥ୍ୟ ସୁରକ୍ଷା ସ୍ବୋଗାନ

ଧନଦଉଳତ ଅଦେଇ ଦିନ
ସ୍ବାସ୍ଥ୍ୟ ସୁରକ୍ଷାକୁ ଦେବାଟି ଧ୍ୟାନ ।
ଗାଁ ପରିମଳ ସଫାରଖିବା
ସ୍ବାସ୍ଥ୍ୟପ୍ରତି ଆମେ ଯତନନେବା ।
ମହାମୂଲ୍ୟ ଅଟେ ଆମ ଜୀବନ
ରଖିବା ଏହାକୁ କରି ଯତନ ।
ଅନ୍ଧ ବିଶ୍ବାସରେ ନଦେବା ମନ
ଡାକ୍ତରଙ୍କ କଥା ମାନିବା ଜାଣ ।
ସ୍ବାସ୍ଥ୍ୟକୁ କରିଲେ ଅତି ଯତନ
ବଞ୍ଚିବାକୁ ହେବ ଅନେକ ଦିନ ।
ହାତକୁ ହାତ ମିଳାଇ ଦେବା
ସୁସ୍ଥ ପରିବେଶ ଗଢ଼ି ତୋଳିବା ।
ମଦ ମହୁଳୁ ଦୂରେଇ ଯିବା
ହସର ସଂସାର ଗଢ଼ିତୋଳିବା ।
କଳକାରଖାନା ଧୂଳି ଧୂଆଁକୁ
ପ୍ରଦୂଷଣ ମୁକ୍ତ କରିବା ତାକୁ ।
ଘରେ ଘରେ ବୃକ୍ଷ ଲଗାଇ ଦେବା
ସୁସ୍ଥ ଅମ୍ଳଜାନ ତେବେ ପାଇବା ।
ଭିଦେଶୀ ଖାଦ୍ୟକୁ ହଟାଇ ଦେବା
ସ୍ବ-ଦେଶୀ ଖାଦ୍ୟକୁ ପ୍ରାଧାନ୍ୟ ଦେବା ।

ଶ୍ରୀ ଦିଲ୍ଲୀପ୍ କୁମାର ନାୟକ
ବାଦାମ ପାହାଡ଼ ଲୌହଖଣି
(ଏମ୍.ଏସ୍.ଜି.ଏମ୍. ଆଇରନ୍ ଏଣ୍ଡ ଷ୍ଟିଲ୍ କୋ:ଲିଡ଼)

ସ୍ବାସ୍ଥ୍ୟ ହିଁ ସମ୍ପଦ

ଶରୀରର ନୀରୋଗ ଅବସ୍ଥାକୁ ହିଁ ସ୍ବାସ୍ଥ୍ୟ
କୁହାଯାଏ । କେବଳ ଦେହର ସ୍ବାସ୍ଥ୍ୟ ଭଲ
ରହିଲେ ଯଥେଷ୍ଟ ନୁହେଁ । ମନ ମଧ୍ୟ ସୁସ୍ଥ
ରହିବା ଦରକାର । ପ୍ରତ୍ୟେକ ଲୋକ
ଉତ୍ତମ ସ୍ବାସ୍ଥ୍ୟ ଦରକାର କରନ୍ତି । କାରଣ
ସ୍ବାସ୍ଥ୍ୟ ନଥିଲେ ଆମେ କୌଣସି କାର୍ଯ୍ୟ
କରିପାରିବା ନାହିଁ । ଆମେ ଆମ
କର୍ତ୍ତବ୍ୟରେ ସବୁବେଳେ ଅବହେଳା
କରିବା । ତେଣୁ ସ୍ବାସ୍ଥ୍ୟ ପ୍ରତି ଯତ୍ନବାନ
ହେବା ଉଚିତ ।
ସ୍ବାସ୍ଥ୍ୟ ହିଁ ସମ୍ପଦ, ଉତ୍ତମ ସ୍ବାସ୍ଥ୍ୟ ବିନା
ଜୀବନର ମୂଲ୍ୟ କିଛି ନାହିଁ । ତେଣୁ
ସମସ୍ତେ ସ୍ବାସ୍ଥ୍ୟ ପ୍ରତି ସତେତନ ହେବା
ନିତାନ୍ତ ଆବଶ୍ୟକ ।

କନକଲତା ଏକ୍ସ
କୁରମିତାର ଲୌହ ଖଣି

ସୁରକ୍ଷା ପୋଷାକ

ସୁରକ୍ଷା ପୋଷାକ'ର ମହତ୍ତ୍ବ ଶୁଣି ରେ ଭାଇ
ଆମ ଜୀବନ ପାଇଁ କେତେ ମୂଲ୍ୟବାନ ଅଟେ
ସୁରକ୍ଷା ପୋଷାକ'ର ଉପକାରିତା ଅରେ ଶୁଣିଲେ
ଦେହରୁ କେବେ ଏହାକୁ ନ ଉତ୍ତାରିବୁ ଭଲେ
ସୁଣିଲେ ଏହାର ରହିଛି ଯେଉଁ ସବୁ ଗୁଣ
ନିଜେ କହିବୁ ତୁ ଏହା ଅଟେ ମୋପାଇଁ ରାମବାଣ ।

ଅନ୍ଧାର ରାସ୍ତାରେ ଯେବେ ତୁ ଥିବୁ
ସୁରକ୍ଷା ପୋଷାକ ଦେହେ ଧାରିବୁ
ସୁରକ୍ଷା ପୋଷାକ ଦେହେ ତୋ ଥିଲେ
ଦୁର୍ଘଟଣା ଯମ ପାଖ ନମାଡ଼ଇ ଭଲେ ।

ସୁରକ୍ଷା ପୋଷାକ ହେବ ତୋରକ୍ଷା କବଚ
ଦୂରୁ ଯାନବାହାନ ହୋଇଯିବେ ସତର୍କ
କେବେ ନମାଡ଼ିବେ ତୋହରି ପାଖ ।
କର୍ମ କ୍ଷେତ୍ରକୁ ଯେବେବୁ ଯିବୁ
ସୁରକ୍ଷା ପୋଷାକ ପ୍ରଥମେ ଦେହେ ଧାରୀବୁ
ସୁରକ୍ଷା ପୋଷାକ କଲେ ଧାରଣ
ପାଖ ନମାଡ଼ିବ ଦୁର୍ଘଟଣା ରାବଣ ।

Sarbeswar Parida
Kurmitar Iron Ore Mines, OMC Ltd.

ସୁରକ୍ଷା ହାତ କବଚ

କେବଳ ହାତ ସୁରକ୍ଷା ପାଇଁ ନୁହେଁ
ବରଂ ସମଗ୍ର ପରିବାରର ସୁରକ୍ଷା ପାଇଁ
ସୁରକ୍ଷା ହାତ କବଚ (ହ୍ୟାଣ୍ଡଗ୍ଲୋଭ୍) ଆବଶ୍ୟକ ।
ହାତ ଦେଇଥାଏ ପେଟକୁ ଭାତ,
ହାତ ସୁରକ୍ଷାକୁ ଅବହେଳା ନକରିବୁ ତାତ ।
ହାତଥିବା ଲୋକ କାର୍ଯ୍ୟକୁ ଲୋଡ଼ା,
ହାତ କଟିଗଲେ ହେବୁକୁ ସର୍ବହରା ।
ହାତଟି କେବଳ ନୁହେଁ ତୋହରି,
ସମଗ୍ର ପରିବାର ଭାର ଉଠାଇଥାଇ ।
ଭାରି ବସ୍ତୁ ଯେବେ ଉଠାଇବୁ ତୁହି,
ସୁରକ୍ଷା ହାତ କବଚ ଧାରଣ କରିଥିବୁ ଭାଇ ।
ଭାରି ବସ୍ତୁ ଯଦି ହାତେ ପଡ଼ିବ,
ଖତ ବିକ୍ଷତରୁ ହାତକୁ ଟ୍ରାହି ମିଳିବ ।
ବୈଦ୍ୟାଧିକ କାର୍ଯ୍ୟ କରିବା ବେଳେ,
ଖାଲିହାତେ ଅଗ୍ରସର ନହେବୁ ଭଲେ ।
ହାତକୁ କବଚ ତୁ ଆଗନାହିଁବୁ,
ତା'ପରେ ଯାଇ କାର୍ଯ୍ୟାରମ୍ଭ କରିବୁ ।
ହାତ କବଚକୁ କଲେ ଧାରଣ,
ବିଦ୍ୟୁତ୍ ଝଟକାରୁ ଯିବୁ ବଢ଼ିଣ ।
ଗ୍ୟାସ୍ କଟରରେ ଯେବେ ବସ୍ତୁ କାଟିବାକୁ ଯିବୁ,
ହାତେ ତୋର ହାତ କବଚ ଧାରଣ କରିବୁ,
ତେବେ ହାତ କଟିବା ଭୟକୁ ଏଡ଼ାଇ ପାରିବୁ ।
କାର୍ଯ୍ୟକ୍ଷେତ୍ରେ ସଦା ଧାରଣ କରିବୁ,
ହାତ ସୁରକ୍ଷା କବଚ,
ସୁରକ୍ଷିତ ସଦା ଥିବୁ ମଥା କରିଉଛ ।
ହାତ ଆମପାଇଁ ଶତ ସିଂହର ବଳ,
ନିଜେ ସୁରକ୍ଷିତ ରହି ବନ୍ଧୁ ସହୋଦରଙ୍କୁ
ସୁରକ୍ଷା ସତର୍କ କଲେ ମିଳିବ ଉପଯୁକ୍ତ ଫଳ ।
ସୁରକ୍ଷା ହ୍ୟାଣ୍ଡଗ୍ଲୋଭ୍ ଆବଶ୍ୟକ,
କିନ୍ତୁ ଧାର୍ମିକ ସରଂକ୍ଷଣ କାର୍ଯ୍ୟ ଗୁରୁତ୍ବପୂର୍ଣ୍ଣ ।

Sarbeswar Parida
Kurmitar Iron Ore Mines, OMC Ltd.

ସୁରକ୍ଷା ଜୋଡ଼ା

ସୁରକ୍ଷା ଜୋଡ଼ା ଆବଶ୍ୟକ
କିନ୍ତୁ ଦୃଢ଼ ଏବଂ ନିରାପଦ ପଦକ୍ଷେପ ଗ୍ରହଣପୂର୍ଣ୍ଣ ।
ପାଦରେ ସୁରକ୍ଷା ଜୋଡ଼ା
ହାତେଥିଲେ ସୁରକ୍ଷା କବଚ
ମାଡ଼ି ଚାଲିଯିବୁ ତୁହି କଣ୍ଟକ ପଥ ।
ଭାରିବସ୍ତୁ ଯଦି ତୋର ପାଦରେ ପଡ଼ିବ,
ସୁରକ୍ଷା ଜୋଡ଼ା ପିନ୍ଧିଥିଲେ ବିପଦ ଚଳିବ ।
ଝୁଣ୍ଟିପଡ଼ିଲେବି ପାଦ ତୋର କ୍ଷତାକ୍ତ ନହେବ,
ସଦା ଯଦି ପାଦେ ତୋର ସୁରକ୍ଷା ଜୋଡ଼ା ଥିବ ।
ବିଦ୍ୟୁତ୍ତାର ସଂସ୍ପର୍ଶରେ ଆସିଲେ ତୁହି
ସୁରକ୍ଷା ଜୋଡ଼ା ଯଦି ପାଦେ ଥାଇ
ଯମ କେବେତୋ ପାଖ ମାଡ଼ିବନି ଭାଇ ।
ହାତେ, ହାତ ସୁରକ୍ଷା କବଚ
ଥିଲେ ପାଦ ଜୋଡ଼ା
ତେବେ ତୁ ହୋଇବୁ ଜଗତ ଜିତା ।

Sarbeswar Parida
Kurmitar Iron Ore Mines, OMC Ltd.

ନାସା ସୁରକ୍ଷା ଉପକରଣ

କେବଳ ନାସା (ନାକ)ର ସୁରକ୍ଷା ପାଇଁ ନୁହେଁ
ବରଂ ସମ୍ପୂର୍ଣ୍ଣ ଶରୀର ପାଇଁ ସେପ୍ଟି ମାସ୍କ ଆବଶ୍ୟକ ।
ନାସା ସୁରକ୍ଷା ଉପକରଣ
ଆମ ସମ୍ପୂର୍ଣ୍ଣ ଶରୀରକୁ ସୁସ୍ଥ ରଖୁଥାଏ ଜାଣ ।
ବାହାର ପ୍ରଦୂଷିତ ବାୟୁ, ଧୂଳିକଣାରେ
ରହିଥାଏ ଅନେକ ଜୀବାଣୁ,
ଆମ ନାସାଦେଇ ଶରୀରକୁ ଯାଇ
ବିଭିନ୍ନ ରୋଗ ସଂକ୍ରମିତ କରିଥାଏ ତେଣୁ ।
ଧୂଳିକଣାରେଯେ ଅନେକ ଜୀବାଣୁ ଲୁଚିକରିଥାଏ
ଖାଲି ଆଖିରେ ଯାହା ଆମକୁ ଦେଖାଦେଇନଥାଏ ।
ଆମ ଅଜାଣତେ ତାହା ଶରୀରକୁ ଯାଏ
କାଶ, କଫ, ହୃଦରୋଗ ଆଦି
ମାରାତ୍ମକ ରୋଗ ଜନ୍ମାଏ ।
ଖଣି, କାରଖାନାରେ ମାତ୍ରାଧିକ
ପ୍ରଦୂଷିତ ଧୂଳିକଣା ଉଡେ
ଏଣୁ ସଦା ନାସା ସୁରକ୍ଷା ଉପକରଣ
ପିନ୍ଧିବାକୁ ପଡେ ।
ଦାଦା, ବନ୍ଧୁ, ଭାଇ ମୋର ସଦା ମନେରଖୁଥିବ
ନାସା ସୁରକ୍ଷା ଉପକରଣ ଧାରଣ କଲେ
ଭାରାତୀୟ ରୋଗଦାଉରୁ ବଞ୍ଚିବ ।

Sarbeswar Parida
Kurmitar Iron Ore Mines, OMC Ltd.

ସୁରକ୍ଷା ଆଖି ଉପକରଣ

କେବଳ ଆଖି ଦର୍ଶନ ପାଇଁ ନୁହେଁ ବରଂ ଅଭ୍ୟନ୍ତରୀଣ ଦର୍ଶନ ପାଇଁ ଗରଳ ଆବଶ୍ୟକ ।
ଆଖି ମନୁଷ୍ୟର ମୂଲ୍ୟବାନ ସମ୍ପଦ ଆଖିର ଜ୍ୟୋତି ଚାଲିଗଲେ ମଣିଷ ପାଲଟିଯାଏ ଥୁଣ୍ଡା
ବରଗଛ ।
ଥୁଣ୍ଡା ବରଗଛ ଉପକରେ କାଉ, କୋଇଲିଟିଏ ବି ଆଶ୍ରା କରି ନଥାଏ,
ଭାରାକ୍ରାନ୍ତ ପଥକଟି ମଧ୍ୟ ବାଟକାଟି ଯାଲିଯାଏ ।
ଆଖିକୁ କେବେ ଅବହେଳା ନକର ଭାଇ ନେତିଗୁଡ଼ି କହୁଣୀକୁ ଯାଲିଗଲେ
ଯେତେ ଜିଭ ଲମ୍ବାଇଲେ ଆଉ ପାଇବ ନାହିଁ ।
ଝଲାଇ କାର୍ଯ୍ୟବେଳେ ଆଖି ସୁରକ୍ଷା ଉପକରଣ ଯଦି ସହକାରେ କର ଧାରଣ
ରହିବ ଖ୍ୟାତି ଲିଭିବନି କେବେ ଆଖିର ଜ୍ୟୋତି ଯେବେ ପିନ୍ଧୁଥିବୁ ସୁରକ୍ଷା ଉପକରଣ ନାତି ।
ବିଷାକ୍ତ ଧୂଳି ଉଡୁଥିବା ଜାଗାରେ ଭାଇ ଆଖି ସୁରକ୍ଷା ଉପକରଣକୁ ପିନ୍ଧିବା ଭୁଲିବୁ ନାହିଁ ।
ଅଖିରେ ପଡ଼ିଲେ ବିଷାକ୍ତ ଧୂଳି ଅନ୍ଧ ପାଲଟିଯିବୁ ଅନ୍ଧ ଦିନେତୁ ଭାଇ
ସୁରକ୍ଷା ଗରଳ ଆବଶ୍ୟକ କିନ୍ତୁ ଚେତନା ଦର୍ଶନ ଅତ୍ୟନ୍ତ ଗୁରୁତ୍ବ ପୂର୍ଣ୍ଣ ।

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ମଣ୍ଡିକ ସୁରକ୍ଷା ଉପକରଣ

ହେଲମେଟ କେବଳ ମୁଣ୍ଡ ପାଇଁ ନୁହେଁ ମଣ୍ଡିକ ପାଇଁ ଆବଶ୍ୟକ ।
ସୁରକ୍ଷା ହେଲମେଟ ଆବଶ୍ୟକ କିନ୍ତୁ ସକାରାତ୍ମକ ଚିନ୍ତାଧାରା ଗୁରୁତ୍ବ ପୂର୍ଣ୍ଣ ।
ଅଣ୍ଟା ଏବଂ ସୂର୍ଯ୍ୟକିରାନ୍ତ ରକ୍ଷାକରିଥାଏ ହେଲମେଟ ଯାନ-ବାହାନ ପାଇଁ ଏହା ଅତ୍ୟନ୍ତ ଆବଶ୍ୟକ ।
ବନ୍ଧୁ ମାନଙ୍କ ଆଶୀର୍ବାଦ ଏବଂ ପ୍ରିୟଜନଙ୍କ ସମର୍ଥନ ହେଲମେଟ ସମ୍ପର୍କରେ ଭୂମିକା ଗ୍ରହଣ କରିଥାଏ ସମାନ ।
ଭ୍ରମଣ ଦୂର୍ଘଟଣାରେ ହେଲମେଟ ଜୀବନ ବଞ୍ଚାଇଥାଏ ବେଳେବେଳେ ଏହା ପୁଣି ଭଗବାନ ପରି ଦେଖାଯାଏ ।
ମୁଣ୍ଡରେ ମୁକୁଟ ପରି ମୋର ଆଉ ହେଲମେଟ ହେଲମେଟ ମୁଣ୍ଡେଥିଲେ ରକ୍ତା ପରି ହେବି ଉପଯୁକ୍ତ ।
ଏହାର ଅନ୍ତର ଅନେକ ବୈଶିଷ୍ଟ୍ୟ ଯେ ଅଛି ଯିଏ ସଦା ହେଲମେଟ ପିନ୍ଧିଥାନ୍ତି ସେମାନେ ଜାଣନ୍ତି ।
ହେଲମେଟକୁ ତୁମର ଅଭିଭାବକ ଭାବେ ଗ୍ରହଣକର ଭାଇ କାହାଣୀ ହିଁ ନିଜେ ହେଲମେଟ କହୁଥାଏ ଭାଇ ।
ହେଲମେଟକୁ ଯେବେତୁ ମୁଣ୍ଡରେ ଧାରଣ କରିବୁ
ଆଖି, ନାଶା, କର୍ଣ୍ଣ, ପାଟି ଏବଂ ମୁଣ୍ଡ ଏହି ପଞ୍ଚକୋଣକୁ ସର୍ବଦା ସୁରକ୍ଷିତ ରଖିପାରିବୁ ।
ହାତ କିମ୍ବା ଗୋଡ଼ କଟିଗଲେ ବର୍ତ୍ତିଯିବୁ ତୁହି ମୁଣ୍ଡେ ଆଘାତ ଲାଗିଲେ ଜୀବନ ଦୀପ ତୋ କ୍ଷଣିକେ ଲିଭଇ ।
ଯଦି ମୁଣ୍ଡେ କିଛି ଭାରିବସ୍ତୁ ପଡ଼ିଗଲା ଜାଣ ହେଲମେଟ ପିନ୍ଧିଥିଲେ ମୁଣ୍ଡ କ୍ଷତାକ୍ତ ହେବାରୁ ବର୍ତ୍ତି ଯିବୁ ଧନ ।
ଯିଏ ଯିଏ ହେଲମେଟସଙ୍ଗେ ବନ୍ଧିତା ଭାଙ୍ଗିବେ ସେମାନେ ଏ ଦୁନିଆଁ ଛାଡ଼ିବା ପାଇଁ ଆଗୁଆ ପ୍ରସ୍ତୁତ ରହିବେ
ନିଜର ପ୍ରିୟଲୋକ ପାଇଁ ହେଲମେଟ ପିନ୍ଧନ୍ତୁ ଆପଣାର ପରିବାର ସ୍ବପ୍ନ ପଜାର ରଖନ୍ତୁ ।
ଯେଉଁ ମଣ୍ଡିକ ବ୍ୟବହାର କରି ଭାଇ ତୁହି ଲକ୍ଷ ଲକ୍ଷ ଟଙ୍କା ରିଜଗାର କରୁ
ତାହାର ସୁରକ୍ଷା ପାଇଁ ସଦା ହେଲମେଟ ପିନ୍ଧିବା କେବେ ଭୁଲିନଯାଉ ।
ହେଲମେଟ ଏବଂ ପନ୍ଥାଙ୍କର ସମାନ ପ୍ରକୃତି ଏ ଦୁହିଁଙ୍କୁ ଯଦି ମୁଣ୍ଡେ ରଖୁଥିବୁ ତୁହି
ଜୀବନ ଗୋହରି ସଦା ବଞ୍ଚିଯିବ ଭାଇ ।
ଯାନ-ବାହାନ ଚଳାଇବାବେଳେ ସର୍ବଦା ସିରବେଲୁ ପିନ୍ଧନ୍ତୁ,
ଖଣି ଖାଦନ ରେ କାର୍ଯ୍ୟକଳାବେଳେ ସର୍ବଦା ସେପ୍ଟି ହେଲମେଟ ପିନ୍ଧନ୍ତୁ ।
କାର୍ଯ୍ୟ କରିସାରିବା ପରେ କାର୍ଯ୍ୟ କରୁଥିବା ସମୟରେ ନିଜର ସୁରକ୍ଷା ନିଜ ହସ୍ତରେ ।
ତୁମର ନିରାପତ୍ତାପ୍ରତି ଯତ୍ନନିଅ ହେଲମେଟ ବିନା ଯାନ-ବାହାନରେ ବସ ନାହିଁ ମୋର ପ୍ରିୟ ।
ଖଣି ଖାଦନରେ ଗାଡ଼ି ଚଳାଇବାବେଳେ ନିଗର ଗତି ଉପରେ ନଜର ରଖୁଥା ବାବୁ
ବେଗ ୨୦ରୁ ଅଧିକ ହେବାକୁ ଦିଅନାହିଁ କେବେ କାହାରିକୁ କ୍ଷତି ପହଞ୍ଚିବାକୁ ଦିଅନାହିଁ ମୋର ବନ୍ଧୁ ।
ଯେତେବେଳେ ତୁମ ଯୌର୍ଯ୍ୟ ଏବଂ ଅନୁଶାସନ ସହିତ କାର୍ଯ୍ୟ କରିବାକୁ ଶିଖିବ,
ସେଦିନ ମୋର ବନ୍ଧୁ ଗୃହକୁ ନିରାପଦରେ ପ୍ରତ୍ୟାଗମନ କରିପାରିବ ।
ଯତ୍ନସହ କାମ କର ଭାଇ ତୁମକୁ ନିରାପଦରେ ଘରକୁ ଯିବାରଅଛି, ମା' ତେଣେ ଘରେ ଅପେକ୍ଷା କରିଛି
ଭଉଣୀ ରୋଷେଇ ସାରି ବସିଛି, ଭାରିଯା ତୁମ ଫେରିବା ବାଟକୁ ଚାହିଁ ବସିଛି
ପିଲାଛୁଆ ତୁମସଙ୍ଗେ ମିଶିକି ଖାଇବାକୁ ଅପେକ୍ଷାରେ ଚାହିଁ ରହିଛନ୍ତି ।
ତାଙ୍କୁ ତ ନିଜ ମୁହଁ ଦେଖାଇବାର ଅଛି
ତୁମକୁ ସୁରକ୍ଷିତ ରହିବାର ଅଛି ନିଜପାଇଁ ନୁହେଁ ବରଂ ସେମାନଙ୍କ ପାଇଁ ।
ସୁରକ୍ଷା ନିୟମ ପାଳନ କରିବା ଆମର ପ୍ରଥମ କର୍ତ୍ତବ୍ୟ ସମାଜରେ ସମସ୍ତେ ନିରାପଦରେ ରହିବା ।
ନିଶ୍ଚିତ କରିବା ଆମର ସଂକଳ୍ପ ।

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ସୁରକ୍ଷା ର ମହାନତା

କେମିତି ବର୍ଷବିକି ପରିବର୍ଷିକି
ସୁରକ୍ଷାର ମହାନତା;
ଯାହାର ପାଳନେ ବଂଚେ ଧନଜନ
ଇଚ୍ଛଇ ଧରିତ୍ରୀ ମାତା ॥

ସୁରକ୍ଷା ଶିକ୍ଷା, ଅଟଇ ଅମୂଲ୍ୟବିକ୍ଷା
ଆପଣାଇ ଭାଇ, ବଢ଼ାଏ ସୁଜୀବନ ରେଖା
ବିପଦ ସମୟେ ନବଜୀବ କେହି
ଦ୍ରାହିକରେ ଏହି ସୁରକ୍ଷା ॥

ସୁରକ୍ଷା ସାମଗ୍ରୀ ପ୍ରତିଟି ଅଙ୍ଗରେ
କରୁଥିଲେ ବ୍ୟବହାର;
ସୁରକ୍ଷା ନିୟମେ କରୁଥିଲେ କର୍ମ
ଦୁର୍ଘଟଣା ହୁଏ ଦୂର ॥

ଗାଡ଼ିର ଚାଳନା ଅବା ଖାଦାନ
ନ ହେଉ ସେ ନିର୍ମାଣ କର୍ମ;
ସୁରକ୍ଷା ସାମଗ୍ରୀ ଅଙ୍ଗେ ଅଙ୍ଗେ ପିନ୍ଧି
ମାନିବ ସୁରକ୍ଷା ଧର୍ମ ॥

ଟୋପି ଆଉ କୋଡ଼ା, ଚଷମା, ଦସ୍ତାନୀ
ନାକମୁଖା ଯଦିଥିବ;
ଏ ‘ପଞ୍ଚକବଚ’ ଜୀବନରକ୍ଷକ
ଦେଖୁ ଯମ ନଆସିବ ॥

ଖଜିର ସୁରକ୍ଷା ନିୟମ ମାନିଲେ
ଅକାଳେ ଯାଏନା ପ୍ରାଣ;
ସୁରକ୍ଷାକୁ ଜରିଥିଲେ ଖାଦାନ
ତିଷ୍ଠିରହେ ଶିଳ୍ପୀୟନ ॥

ବ୍ୟକ୍ତିତ୍ୱ ସୁରକ୍ଷା ହୋଇବ ସର୍ବଦା
ଧାନ୍ତଶିଖ, ଭଦ୍ରପଣେ;
ନାରୀ ସୁରକ୍ଷିତ ହୋଇବ ସମାଜେ
ଶୃଙ୍ଖଳିତ ଆଚରଣେ ॥

ମାଓ ଶିବିରରେ ସୁରକ୍ଷିତ ଧୂନି
କରାଇଲେ ଗୁଞ୍ଜରିତ;
ଆତଙ୍କବାଦର ବିଲୋପ ଘଟିବ
ଭିଣ୍ଡି ହେବ ସୁରକ୍ଷିତ ॥

ସୁରକ୍ଷାର ଧୂଳା ଉଡ଼ିଲେ ସୀମାରେ
ଜାତୀୟ ପତାକା ପରି;
ସୁରକ୍ଷାର ବଳ ଲଭିଣ ସୈନିକ
ଯୁଦ୍ଧିବ ସେ ସିଂହ ପରି ॥

ଧର୍ମ ଶିକ୍ଷାମାତ୍ର ଦିଏ ବାଇବେଲ
ପୁରାଣ, କୋରାନ, ଗୀତା
‘ସୁରକ୍ଷା ପୁସ୍ତକ’ ବଂଚାଏ ଜୀବନ
ଏହି ତା’ର ମହାନତା ॥

ସୁରକ୍ଷା ଦୀକ୍ଷାକୁ ଆପଣେଇ ନେଇ
ପାଳରେ ସୁରକ୍ଷା ନୀତି;
ଦୀର୍ଘଜୀବି ହୁଅ ଏ ବିଶ୍ୱ ବଞ୍ଚାଅ
ବଞ୍ଚୁ ଏ ମାନବ ଜାତି ॥

ରଘୁନାଥ ସାହୁ
ମାଲନଂ ଇଂଜିନିୟର
ଓସ୍ତପାଳ ମାଲନ୍, ବେଦାନ୍ତ-ଫେକର ଲିମିଟେଡ
ଫୋନ୍-୭୪୩୭୮୮୧୭୦୭

ଦ୍ୱିପାକ୍ଷୀକ ଏବଂ ତ୍ରୟୀପାକ୍ଷୀକ ସୁରକ୍ଷା କମିଟି ର ଉଦ୍ଦେଶ୍ୟ

ଖଣି ପ୍ରବନ୍ଧକ, ଶ୍ରମିକ ସଂଗଠନ ଓ ଖଣି ସୁରକ୍ଷା ନିର୍ଦ୍ଦେଶକଙ୍କ ଭିତରେ ଖଣିର ବିପଦ
ବିଷୟରେ ଖୋଲାଖୋଲି ଚର୍ଚ୍ଚା ହୁଏ, ସେଗୁଡ଼ିକ ହେଲା

- ❖ ଖଣିରେ ଯଦି କିଛି ଘଟଣା କିମ୍ବା ଦୁର୍ଘଟଣା ଓ ବିପଦ ପଡେ, ସଠିକ ସୁଖାବ ଦେବା ଓ ତାକୁ କାର୍ଯ୍ୟକାରୀ କରିବା
- ❖ ସୁରକ୍ଷାର ମନ ବଢାଇବା ସହିତ ଆନସେଫ ପରିସ୍ଥିତି ଓ ଆନସେଫ ଅଳ୍ପ କୁ କମାଇବା
- ❖ ଖଣି ପରିଦର୍ଶନ କରି ଖଣିର ସୁରକ୍ଷା ବିଷୟରେ ଜାଣିବା
- ❖ କିପରି ସ୍ୱାସ୍ଥ୍ୟ, ସାମାଜିକ ଓ ସୁରକ୍ଷା ବୃଦ୍ଧି ହେବ ସେଥିପାଇଁ ଚର୍ଚ୍ଚା କରିବା
- ❖ ଖଣି ଶିଳ୍ପରେ ସୁରକ୍ଷା ଓ ସ୍ୱାସ୍ଥ୍ୟ ପାଇଁ ମୁଖ୍ୟ ଭୂମିକା ନିଭାଇବେ
- ❖ କମିଟି ଓ କୌଚ ଅଫ ଇନ୍ସୁଆରୀ ର ସ୍ପେଟସ କାର୍ଯ୍ୟକାରୀ ଉପରେ ଚର୍ଚ୍ଚା କରିବେ
- ❖ ଖଣି ସୁକ୍ଷ୍ମ ନିର୍ଦ୍ଦେଶକଙ୍କର ଯଦି କିଛି ଭାୟୋଲେଶନ ଅଛି ତାହା ଉପରେ ଚର୍ଚ୍ଚା କରିବେ

ସତ୍ୱକ ସୁରକ୍ଷା

ପୃଥିବୀରେ ସବୁବେଳେ ଅଂସଖ୍ୟ ସତ୍ୱକ ଦୁର୍ଘଟଣା ଘଟୁଛି ଓ ଭାରତରେ ପ୍ରତିଦିନ ଅନେକ
ଲୋକ ଦୁର୍ଘଟଣା ରେ ପ୍ରାଣ ହରାଇଛନ୍ତି ଓ ଦୈନିକ ସମ୍ଭାବନା ପୃଷ୍ଠାରେ ତଥା ଦୂରଦର୍ଶନ
ପରଦାରେ ଆମେ ଦୁର୍ଘଟଣା ର କରୁଣ କାହାଣୀ ଦେଖିବାକୁ ପାଉ । ଏହି ଦୁର୍ଘଟଣା ମଧ୍ୟରୁ
କେତେକ ଆକସ୍ମିକ, କେତେକ ପାକୃତିକ ଓ ଅନେକ ମନୁଷ୍ୟ ଅସାବଧାନତା କାରଣରୁ ଏହି
ସବୁ ସତ୍ୱକ ଜନିତ ଦୁର୍ଘଟଣା ଗୁଡ଼ିକୁ ସଚେତନତା ମାଧ୍ୟମରେ ସଂଶୋଧନ କରିପାରିବା
ଏବଂ ସୁରକ୍ଷାକୁ ପ୍ରାଥମିକତା ଦେଇ, ସୁରକ୍ଷା ନିୟମ ପାଳନ କରି ନିଜ ସହିତ ସମାଜକୁ
ସୁରକ୍ଷିତ କରିପାରିବା ।

ଝୁର୍କମେନ ର ନିରୀକ୍ଷକ

- ❖ ମାଲକ୍ସ ରୁଲ୍ ୧୯୫୫ ର ଧାରା ୭୯ ଅନୁସାରେ ନିଯୁକ୍ତି ଦେବେ
- ❖ ସବୁ କାର୍ଯ୍ୟସ୍ଥଳ ଓ ଯେଉଁ ଗାଡ଼ିରେ ଶ୍ରମିକ କାର୍ଯ୍ୟସ୍ଥଳକୁ ଯିବାଆସିବା କରୁଛନ୍ତି ତାହା
ନିରୀକ୍ଷଣ କରିବେ
- ❖ ଖଣିରେ ଯଦି କୌଣସି ଦୁର୍ଘଟଣା କିମ୍ବା ବିପଦ ଆସେ ସେ ତୁରନ୍ତ ଖଣି ପ୍ରବନ୍ଧକ କୁ
ଜଣାଇବା ସହିତ ଆଞ୍ଚଳିକ ଖଣି ସୁରକ୍ଷା ନିର୍ଦ୍ଦେଶକଙ୍କୁ ଜଣାଇବେ ।
- ❖ ଖଣି ନିରୀକ୍ଷଣ ସମୟରେ ମୁଖ୍ୟ ଓ ଆଞ୍ଚଳିକ ଖଣି ନିର୍ଦ୍ଦେଶକଙ୍କ ସହ ରହିବେ ଏବଂ
ଫର୍ମ ଯୁ ରେ ରିପୋର୍ଟ କରି ହସ୍ତାକ୍ଷର କରିବେ ।