Zinc Market Review

GLOBAL DEMAND

Calendar year (CY) 2021 saw the COVID-19 pandemic persist, with several economies facing second or third waves with global imposition of lockdowns. Certain sectors like automobile and alloys were badly hit, although industrial activity was not impacted as much as in the first wave. Demand, however, started to pick up from the third quarter of the financial year. Led by expansion in manufacturing activity, zinc markets staged a robust recovery in CY 2021, with consumption growing by 7.1% to 14.15 Mt, one of the highest levels witnessed in the recent past.

The second half of CY 2021 saw smelter disruption in Europe, with high energy prices and carbon emission taxes prompting some smelters to reduce output during times of peak power costs, leading to energy shortages. The energy crisis was further escalated by the Russia-Ukraine war, as Europe is mostly dependent on Russia for energy. The disruption in the commodity market was particularly serious in the month of March 2022, causing the London Metal Exchange (LME) to intervene and halt nickel trading in view of extreme price volatility. This caused a cascading effect on LME prices and witnessed zinc prices touching an all-time high of US$ 4,896/t.

Zinc is mostly consumed by the construction sector, followed by transport and infrastructure sectors. In terms of first use, galvanising dominates, followed by fertiliser, die-casting alloys, brass semis, and casting. India has emerged as one of the stronger growth drivers in Zinc consumption across the world in post pandemic times. Demand in most of the first use applications has been restored back to pre-pandemic times. Further emerging areas of zinc-based application (with potential to replace lithium ion and lead-acid batteries) and renewable energy are likely to provide a push in the medium term. Renewable energy projects will provide an opportunity for use of galvanised steel in plant construction as well as transmission towers.

PRODUCTION

Global zinc mined metal production (metal in concentrate) grew by 7.3% to 13.16 Mt in CY 2021 and predicted to rise further in the medium term as new production comes up. Zinc refined metal production grew marginally to 13.84 Mt in CY 2021. Smelters, however, faced the challenge of high-power costs and some even resorted to production cuts. Concentrate levels, which were impacted due to loss of mine production in CY 2020 and slipped into a deficit, showed an improvement of 1.06 Mt, and came back to a net supply surplus from Q3 CY 2021. It is expected to return to normalcy in CY 2022 and CY 2023. Global refined zinc metal inventory is also expected to normalise.

INDIA DEMAND AND OPPORTUNITY

India's zinc consumption grew by approximately 13% in FY 2021-22 to 630 kt, after witnessing a sharp fall of 15% during COVID-affected FY 2020-21. While demand in the first quarter (April-June 2021) shrank by 20% due to the second wave of the pandemic, it eventually picked up from the second half of FY 2021-22, demonstrating a 'V-shape' recovery. Much of this growth came from the infrastructure sector and huge government projects announced in the second half of the year.

The Indian government's 5 trillion-dollar economy vision, the Steel Ministry's ambition to enhance India's steel production capacity by 2.5x to 300 Mt, 5G roll-out and target for 100% electrification are likely to further boost zinc demand. The Central Government's ₹6 lac crore asset monetisation pipeline during FY 2022-25 is likely to give further impetus to zinc demand. Funds sourced from these initiatives are proposed to be channelised towards roads, railways, power generation and transmission, and telecom projects among others. These projects require significant use of galvanised steel, which will aid zinc demand.

There is also a huge potential for galvanised sheets and various zinc alloys in the government's smart cities project, envisaged with modern real estate. Zinc, as an emerging technology, is also well poised for usage in battery application. Given the abundance of zinc in India, the metal is well-positioned to replace imported lithium in battery applications, and thus further promoting India's self-reliance journey related to metal consumption.

GLOBAL OUTLOOK

As per WoodMac, global zinc consumption is likely to grow by 1.3% in CY 2022 and average 1.7% during CY 2023 and CY 2024, as governments across the world switch focus from job creation to de-carbonisation and infrastructure. Compared with zinc's recent pre-pandemic history, this is a robust growth rate, sufficient to lift consumption to 14.5 Mt, thus surpassing the 2017 all-time high of 14.2 Mt.

Majority of the growth is likely to be driven by investments in infrastructure and other forms of construction in developing regions, especially Asia, as opposed to the matured economies of developed nations. Demand in Asia is expected to grow at an average of 1.8% during this period. China is expected to remain the largest market, contributing to over 70% of the increased global zinc consumption, despite a sharp slowdown in its real estate construction.

BUSINESS OVERVIEW

Hindustan Zinc, with a primary zinc market share of 80% (including alloys) in FY 2021-22, remained India's largest primary zinc producers. Our portfolio includes a range of zinc products including special high grade (SHG), high grade (HG), continuous galvanising grade (CGG), prime western (PW), jumbo SHG and other grades used in die-casting alloys. This makes us an attractive player in India, where over 70% of the demand comes from galvanising steel, used in construction and infrastructure sectors. Our SHG zinc products are registered with LME. We are working closely with customers to enhance the robustness of our zinc product portfolio in terms of value-added products (VAP).

Hindustan Zinc, in collaboration with International Zinc Association (IZA), is working on multiple projects to increase zinc consumption in India. We are creating awareness on use of zinc as an alternative raw material in battery solutions. India's current energy capacity of 60-65 GWh is expected to reach 600-700 GWh as per CRISIL, with zinc-based batteries touching 10-15%. We are in discussion with several experts working globally on technology options for zinc-based batteries.

Our galvanised rebar segment is picking pace and expected to grow by 22.56% CAGR till 2030. We are working on increased consumer awareness alongside IZA. As our rail track galvanisation project is at an advanced stage we are witnessing a positive development, which can increase zinc consumption in the country. We are also working on a flagship initiative alongside IZA on zinc deficiency in soil.

Performance Highlights, FY 2021-22

- Mined zinc production increased 6% to 801 kt
- Refined zinc production increased 8% to 776 kt
- Revenue from zinc sales grew 45% to ₹20,299 crore
- Sales from VAP increased from 16% in FY 2020-21 to 20% in FY 2021-22

2.3%

Zinc consumption expected to grow in CY 2022

Lead Market Review

GLOBAL DEMAND

Global refined consumption increased by 3.8% in CY 2021 reaching 13 Mt after declining to 12.5 Mt in CY 2020. Refined lead consumption is expected to reach 13.7 Mt by CY 2023. The Chinese and Indian automotive sectors are expected to be the main drivers of global demand along with other Asian countries.

PRODUCTION

Lead mined metal output (metal in concentrate) grew 5.8% in CY 2021 to 4.54 Mt after declining by 7.9% in CY 2020 due to pandemic. According to WoodMac, lead mined metal production is expected to grow at a CAGR of 1.4% during CY 2021-26 with lead mined metal production expected to reach 4.9 Mt in CY 2023. Production of secondary lead is expected to grow 2.9% in CY 2022 before normalising and attaining average growth of 1.4% during CY 2022-32.

INDIA DEMAND AND OPPORTUNITY

Lead consumption in India increased marginally from 1 Mt in CY 2020 to 1.11 Mt in CY 2021. Refined lead production increased from 1 Mt in CY 2020 to 1.14 Mt in CY 2021, of which 0.23 Mt was primary and 0.91 Mt secondary production.

The country remains an attractive market for lead with demand likely to increase with an average growth of 6.4% until 2031, as estimated by WoodMac. The growth will be driven by the automotive sector and inverter battery market. Emerging opportunities like energy storage for electricity generated from photovoltaics (PV) will also drive demand, given India's ambitious plan to aggressively expand solar PV capacity by 2030.

Major domestic battery manufacturers continue to grow lead acid battery manufacturing capabilities on account of sustained demand. Apart from automotive, the industrial battery segment catering to data centres, financial institutions and telecom continue to witness strong growth in line with the digitalisation surge in the country.

PRICES

LME started with a price of US$ 1,896/tonne in March 2021 and touched US$ 2,513/tonne in March 2022. Prices of lead have remained stagnant in a range US$ 2,100-2,500/tonne in FY 2021-22 and expected to remain within this range over the next financial year.

GLOBAL OUTLOOK

According to WoodMac, the global demand forecast for the medium term (2022-27) is estimated at 1.6% pa. This growth would be driven mainly by Asian countries. The average demand growth during 2022-32 is expected to be around 1.7%. Restocking of supply chains especially in North America and Europe along with pent-up automotive demand, mostly from China, India and other Southeast Asian countries is likely to ensure sustained demand of lead.

Despite rising development in new battery technologies, mainly for hybrid and battery electric vehicles designed to replace the internal combustion engine, the conventional demand for lead acid batteries is expected to sustain. This includes uses for powering ancillary systems such as engine monitoring, climate control, satellite navigation systems and to maintain stable voltages for vehicle management computers.

A major portion of lead demand is likely to come from developing economies growing at an average of 3.1% until 2031. Rising vehicle production and penetration, infrastructure development and new telecom networks (ongoing 4G and upcoming 5G) will continue to support demand growth.

BUSINESS REVIEW

OVERVIEW

Hindustan Zinc is one of the leading lead producers in India with a market share of 76% in the primary market in FY 2021-22. We produce lead ingots with 99.99% purity, which are registered with LME. Majority of our sales is in the domestic market and the rest is exported to Southeast Asian markets. We continue to be focussed on increasing sales through new customers, e-commerce platforms and introduction of lead alloys in our product portfolio.

Performance Highlights, FY 2021-22

- Mined lead production remained flat at 216 kt
- Refined lead production decreased 11% to 191 kt
- Revenue from lead sales grew 7% to ₹3,550 crore

4.5%

Lead consumption is expected to rebound strongly in CY 2022

Silver Market Review

GLOBAL DEMAND

Global silver demand rose by a healthy 19% last year, surpassing pre-pandemic volumes and achieving its highest level since 2015. Demand gained in all categories of silver, with the largest in volume gains being coin and bar purchases, followed by industrial demand. This trend reflects the recommencement of industrial operations and re-opening of businesses as economies began to recover from the COVID-19 pandemic. Other supportive factors included a boom in consumer electronics, 5G infrastructure investment, inventory build along the supply pipeline and rising end-use in the green economy, chiefly in photovoltaics.

PRODUCTION

In CY 2021, global mine production increased by 5.3% year-on-year (y-o-y). This was the biggest annual rise in silver output since CY 2013 and was largely the result of a recovery in production following significant disruption to mining during the COVID-19 pandemic in CY 2020. Output from primary silver mines increased the most, up 10.2% y-o-y, as these operations were disproportionately impacted by pandemic-related restrictions in CY 2021.

INDIA DEMAND AND OPPORTUNITY

India is currently the world's third largest silver physical investment market after US and Germany. The silver bar market has been extremely successful, with around 15,000 tonnes of silver having been bought cumulatively over the last 10 years. The middle class Indian household regularly buys silver for investment and in the form of tableware and cutlery for household use. Silver purchase is considered a safety net for times of financial distress and hence, domestic consumption on the physical side is sizeable. Although new consumption themes are evolving and there is a growing popularity of e-commerce platforms including Amazon and Flipkart as an alternate destination for buying silver coins/bars, holding physical silver still involves space constraints and security concerns.

The silver investment market is witnessing a slow change, with digital silver and silver ETFs both gaining popularity. The Securities and Exchange Board of India (SEBI) has allowed silver ETFs. Several mutual funds have launched silver ETFs, including Aditya Birla Sun Life, Nippon India and ICICI Prudential. All these factors together bode well for the silver investment market in India.

PRICES

During FY 2021-22, silver moved from trading within a US$ 24-28 range for most of the first half of last year to fluctuating within a US$ 22-26 band during the second half. Still, the full-year 2021 average achieved a 22% y-o-y increase to a nine-year high of US$ 25.14. Russia's invasion of Ukraine in late February 2022, the conflict and its implications on trade and the world economy have become a principal driver of the global market. The price is expected to remain range bound in the US$ 21-US$ 25 band.

**Source: World Silver Survey 2022*

Performance Highlights, FY 2021-22

- Refined silver production decreased 8% to 647 MT
- Revenue from silver sales declined by 4% to ₹4,206 crore

MINES PERFORMANCE OVERVIEW

Mining Milestones

At Hindustan Zinc, we remain committed to sustainable mining backed by focussed investments to enhance safety, productivity, and efficiency at our mines. We are leveraging automation and technology to make our mines safer, in line with our Sustainability Goals 2025. Our efforts are also centred on making our mines more environment-friendly to steer our decarbonisation journey.

FY 2021-22 marked a major milestone in terms of our best-ever mined metal production of 1,017 kt, up 4.6% year-on-year. We celebrated the crossing of the one million tonnes production mark on account of higher ore production across most of our mining locations.

> The operational excellence we delivered during the year was the successful manifestation of our diligent and innovative approach. Confronted by various setbacks and hurdles, we gained from our learning experiences to emerge stronger and better through the highs and lows of the year. This translated into improved performance and new highs in MIC delivery, ore hoisting, Zn & Pb recoveries, and other areas. We are well and truly on course to usher in a new era of growth and set global benchmarks through our breakthrough innovations, centre of excellence and digitalisation drive. Our renewed focus on steering safety (zero harm), innovation, quality, automation and optimal operational metrics will help us raise the bar of excellence. It will enable us to push the momentum of growth further as we surge towards enhanced capacities and capabilities."
>
> **Praveen Sharma**
> COE Mining - Head

KEY NUMBERS

107.30 km
Total Mine Development

1,017 kt
Total Mined Metal

801 kt
Mined Metal - Zinc

216 kt
Mined Metal - Lead

5 Mines with total ore production of

16.34 Mt

Particulars	Ore Mined		Zinc Mined Metal				Lead Mined Metal			
	2020-21	2021-22	2020-21		2021-22		2020-21		2021-22	
	('000 Tonnes)	('000 Tonnes)	('000 Tonnes)	Grade (%)	('000 Tonnes)	Grade (%)	('000 Tonnes)	Grade (%)	('000 Tonnes)	Grade (%)
Rampura Agucha	4,273	**4,511**	415	10.89	**455**	**11.16**	38	1.61	**46**	**1.64**
Sindesar Khurd	4,842	**5,230**	157	3.39	**166**	**3.33**	100	2.20	**97**	**2.02**
Rajpura Dariba	1,215	**1,252**	38	4.60	**41**	**4.78**	8	1.22	**7**	**1.08**
Zawar	3,951	**4,411**	89	2.48	**100**	**2.45**	62	1.86	**61**	**1.55**
Kayad	1,175	**934**	56	5.15	**40**	**4.57**	7	0.80	**5**	**0.66**
Total	**15,456**	**16,339**	**756**	**5.45**	**801**	**5.43**	**216**	**1.78**	**216**	**1.65**

Being the flagship mine of Hindustan Zinc, Rampura Agucha Mine is at the forefront of operational excellence. The mine is one of the most mechanised and digitally-driven underground mining locations. We are continuously endeavouring to scale the mine's operations and remain focussed on sweating the assets effectively.

We are focussed on upgrading the maintenance infrastructure and practices at the mine, concertedly implementing best-in-class operating practices and focussing on improving the skill level of our workforce with the aim of developing the RA location as a Model AO location."

Kishore Kumar S
Chief Executive Officer - Agucha IBU

Having set in motion a well-articulated plan to create a unique digital-enabled mine, we are now focussed on proactively leveraging digital capabilities, including Artificial Intelligence (AI), through targeted initiatives. The focus, going forward, will be not just on improving the operational efficiencies at the mine through acceleration in its digital and technology transformation but also on creating a 100% safe working environment for our workforce and business partners. Building capabilities to detect deviation from our safety standards, using wi-fi to track movement of personnel and equipment in the underground mine, enabling tech-enabled remote operations and powering smoke hour drilling have emerged as some of the key areas of focussed intervention. While improving the safety environment and reducing the operational cost of extraction, these initiatives will also help lower our carbon footprint in line with our strong ESG commitment."

Vinod Jangir
Chief Executive Officer - Dariba IBU

The historic high 1 Mtpa production milestone notched by Hindustan Zinc during FY 2021-22 underscored the success of our efforts towards building a culture of robust mine planning, aligned to global standards. We have designed our planning processes to the organisation's long, medium and short-term goals and vision. Our efforts are now steered towards progressing further on the roadmap for achieving 1.2 Mtpa mine capacity in the near term, at the back of our sustained focus on more seamless mine planning and safety augmentation. We are optimistic about achieving our targets with the help of the best-in-class professionals hired from across the global at our locations and the nurturance of a sustainable culture across the organisation. For long-term mine planning and design, we have prioritised in-house capacity building as a key thrust area, which we shall make strategic investments in strengthening in the months ahead."

Vinod Kumar
Chief Executive Officer - Zawar IBU

RAMPURA AGUCHA MINE PERFORMANCE OVERVIEW

The Rampura Agucha Mine (RAM) is an ISO 9001, ISO 14001, ISO 45001, ISO 50001 and SA-8000 certified underground zinc and lead mine. Located in the Bhilwara district of Rajasthan state, RAM is the largest and richest, lead-zinc deposit in the country and among the world's largest with 75.0 Mt of ore reserves and resources (R&R) with in situ average grade of 10.8% zinc and 2.0% lead on an exclusive basis as on end of FY 2021-22. It is also one of the lowest cost zinc producing mine globally. The mine is equipped with best-in-class infrastructure, operates at high levels of ESG standards, deploys advanced technology for mining activities for better targeting and has some of the best people in the mine's leadership, with extensive community outreach.

PERFORMANCE SNAPSHOT

The Rampura Agucha Mine continued to scale its operations with focussed interventions on operational and technology fronts and new targeted initiatives that led to a 5.6% year-on-year increase in ore production and 10.4% increase in mined metal production over the previous fiscal. RAM is currently producing at 4.5 Mtpa through its underground operations. It is in the process of building infrastructure to support its expansion plan to enhance ore production beyond 4.5 Mtpa.

4.51 Mt
Ore Production

12.80%
Grade

500.49 kt
Mined Metal Production

29.13 kilometres
Mine Development

PERFORMANCE UPDATE

During FY 2021-22, RAM crossed several notable milestones to propel its journey of operational excellence and growth.

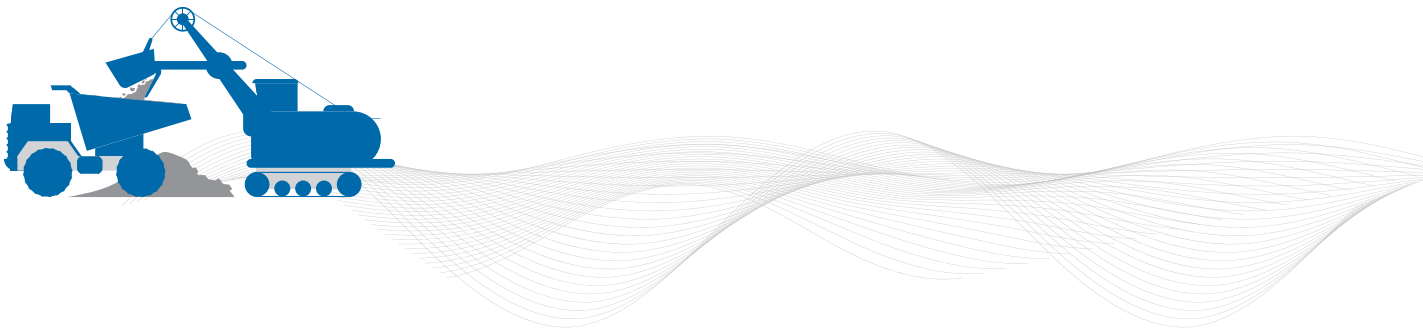
- Commissioning of ventilation infrastructure such as high-capacity fans to enhance mine ventilation capacity from 1,300 m^3/s to 1,600 m^3/s
- Installation and commissioning of Advanced Process Controller (APC) in Ore Beneficiation Plants to boost zinc, lead and silver recovery
- Completion of 9th phase of height raising of Tailing Storage facility
- Installation and commissioning of Metso pump at a depth of 600 metres below surface, to enhance mine dewatering capacity

EXPANSION, UPGRADATION & INFRASTRUCTURE DEVELOPMENT

To create a more enabling environment for future growth, RAM initiated a host of expansion, upgradation and infrastructure development initiatives during the year which are at various stages of completion.

- Life of Mine Plan (LoMP) sump phase-1 will be commissioned to enhance the mine dewatering capacity
- Construction of Underground Maintenance Workshop and facilities is planned which will help to improve equipment efficiency
- Phase-1 diesel filling station will be commissioned as part of the mine infrastructure development plan
- Shotcrete bay commissioning once complete will act as a key enabler to enhance mine development
- South Ventilation Fan will be commissioned which will increase the current ventilation capacity from 1,600 m^3/s to 1,900 m^3/s

Rampura Agucha has successfully commissioned its 2nd underground crusher along with conveyor system enabling full utilisation of 3.75 Mt main shaft hoisting capacity.



EFFICIENCY & PRODUCTIVITY ENHANCEMENT

To boost its operational efficiency and productivity, RAM initiated several concerted measures during the year, particularly in the areas of technical advancement, digitalisation, and automation.

Commissioning of integrated command control centre

This highly digitalised and connected command centre offers end-to-end monitoring and controlling of all mine facilities through a single operator interface for complete operation of mine services

3D visualisation of real-time equipment and personnel monitoring

This will enhance safety, improve productivity of resources, manage traffic and create an advanced technical environment for the workforce

Real-time equipment for health monitoring

It includes use of Optimine, Certiq and OSI PI data visualisation tools, thus increasing utilisation of resources

Proximity warning and anti-collision system installation

This helps to reduce machine to machine and man to machine interaction

Pump automation in underground mine

This will automate the dewatering operations, further creating dashboards to bring real-time updates of drilling water and dewatering status to surface

Training Initiatives

RAM's efficiency and productivity boosting efforts during the year included several new training initiatives. The mine launched the first-of-its-kind virtual reality-based winder simulator in the industry, for ground-mounted Koepe winder system. It also organised a mining mate skill upgradation training programme by a retired DGMS official.

SAFETY INITIATIVES

- Established India's first underground first-aid station with ambulance to enhance safety measures in the underground mine. This first-of-its-kind below-the-ground rescue and aid system is deployed 24x7 at the underground station with a dedicated rescue staff
- Installed fire hydrant lines on the surface and underground to handle any incidents of fire
- Installed sensor-based Auto Ventilation doors underground - Manual Intervention eliminated

SUSTAINABILITY INITIATIVES

Energy Saving

- High density tailing eliminated the requirement of running one disc filter circuit, leading to net annual power savings of 1,526 MWh

Water Conservation

- Recycling and reuse of mine intersection water and tailing dam water undertaken in beneficiation plant
- Treatment and utilisation of domestic waste water done through Sewage Treatment Plants (425 KLD at township and 300 KLD at mine area)
- A Ground Water Recharge project has been undertaken in 84 village ponds in nearby villages with a total potential recharge of 8.7 million cubic metre/annum

Emissions Control

- All engines of new HEMM equipment procured are above Tier-3
- Euro-Stage-V engines introduced in 5 underground production LHDs

Proactive Tailing Management

- Height raising work of tailing dam completed
- Geotechnical instruments installed to monitor stability parameters

Waste Management

- Waste generated from underground mine being used in tailing dam height raising work

CASE STUDY

Real-Time Seismic Monitoring

As RAM is getting deeper, the mine will be associated with seismic activities. To monitor the seismicity, real-time seismic monitoring system has been established in the mine. The system provides real-time information about the exact hypocentre, intensity and frequency of event, which helps in making strategic decisions like stoping sequence and ground support design.

As part of the initiative

Real-time micro-system monitoring system has been installed with 10 sensors covering entire UG working.

Benefits

Based on the monitoring data, stoping sequence can be optimised for minimising seismicity.

Proactive modification of ground support.

As the monitoring system gives exact hypocentre and magnitude of event, the area can be isolated to minimise exposure of men and machine.

CASE STUDY

Installation of fully automated pumping system

The stage pumping network, with frequent pump breakdowns, was causing sump overflow as well as waterlogging at RAM. Further, inefficient slurry handling was leading to gradual mud settlement in the sump. Concerned about this situation, the RAM team sought solutions to enhance the mine dewatering capacity and eliminate stage pumping.

As part of the initiative:

- RAM introduced a mechanised agitation system to eliminate the mud settlement in the sump that also eliminated the requirement of periodic cleaning

Benefits

As a result of installation of this fully automated pumping system:

- Dewatering capacity has been enhanced
- Stage pumping has been minimised, which led to reduced requirement of pumps and better efficiency at lower cost
- Remote parameter monitoring has been enabled from surface control room
- Energy saving has been achieved due to reduction of pumps in the dewatering circuit

AWARDS & ACCOLADES

Won the 'Rajasthan Energy Conservation Awards-2021' to become the only mine to be felicitated with an award by the mining industry

Received the prestigious '5 Star Rated Mines' award from the Ministry of Mines, Government of India, for sustainable efforts and initiatives at RAM

Won the 'Best Application & Uses of Renewable Energy' award at the 5th CII National Energy Efficiency Circle Competition 2021

Won two awards in 'Par Excellence at ICQCC' and 'Excellence at ICQCC' categories, at the 46th International Convention on Quality Control Circles (ICQCC) – 2021, organised by Quality Circle Forum of India (QCFI)

Rampura Agucha Mine received overall 2nd prize for the mine at the 34th Mines Safety Week function

SINDESAR KHURD MINE PERFORMANCE OVERVIEW

Sindesar Khurd (SK) Mine is a world-class silver-rich mine with state-of-the-art infrastructure facilities and best-in-class mechanisation. Since it commenced operations in 2006, the mine has undergone several phases of expansions – from 0.3 Mt to its current capacity of 6.0 Mt. SK Mine today stands out as one of the largest underground mine and one of the lowest cost silver producer in India. The deposit at SK Mine has a main lens and multiple standalone auxiliary lenses, creating multiple independent production centres.

PERFORMANCE SNAPSHOT

In FY 2021-22, SK Mine witnessed 8.0% increase in ore production over FY 2020-21. The Mined Metal Production for the period grew 2.4% year-on-year. Powered by focussed exploration, ~22 kilometres of mine development took place during the year, enabling SK Mine to scale up production and boost its future-readiness.

5.23 Mt
Ore Production

263.73 kt
Mined Metal Production

5.35 %
Grade

21.67 kilometres
Mine Development

PERFORMANCE UPDATE

SK Mine witnessed steady progress on various projects undertaken during the last fiscal year.

- Commissioning of 3rd ore-pass for sustainable ore production from shaft
- Installation and commissioning of automated process control in ore beneficiation plants

EXPANSION, UPGRADATION & INFRASTRUCTURE DEVELOPMENT

The focus on expansion, upgradation, and development of new infrastructure at SK Mine was further sharpened during the year.

- Created new global benchmark with over 1,000 hours paste-filling for five consecutive months (October 2021 to February 2022)
- Advanced Process Controller (APC) implemented in ore beneficiation plants aiding in increased recoveries
- Global best 193,000 m^3 paste-fill in a single month
- Mine ventilation capacity enhanced from 950 m^3/s to 1,450 m^3/s with commissioning of 3 X 1,500 kW mechanical ventilators at new return raises
- Reduction in cement consumption norms, with enhanced utilisation of fly ash in paste-fill mix (cement norms from 108 Kg/m^3 to 95 Kg/m^3)
- Established smoke hour drilling of up to 4,000 metres per month with the deployment of technologically advanced drills

EFFICIENCY & PRODUCTIVITY ENHANCEMENT

Various targeted initiatives were implemented during FY 2021-22 to enhance the mine's efficiency and productivity metrics.

Successfully implemented pilot project for Tele-remote drilling with the deployment of technologically advanced drills

Improvement in recovery of zinc in the beneficiation plants

Installation of chiller units (60 m^3/s) at surface for intake air, to provide cooled air at working face in mine's deepest areas; helped improve the ambient working conditions in summers, resulting in enhanced productivity and efficiency

DIGITALISATION AND SMART INITIATIVES

Real-time monitoring of underground vehicles and persons

Underground pumping automation implemented at 3 pumping stations; another 12 pumping stations' automation to be taken up in FY 2022-23

Integration of shaft system with OSI-PI system for improvement in shaft productivity and reliability

Implemented Skip Rope anomaly detection system for early detection of wire rope defects with position and reduction in manual inspection time

Short Interval Control (SIC) established in operational planning to leverage technology in day-to-day activities of planning, scheduling and tracking

SAFETY INITIATIVES

- Radar-based sensors installed in LPDTs to prevent machine-machine and man-machine interaction while reversing
- Introduction of new-age fire fighting vehicles, dedicated to strengthening firefighting below ground; established fire banks at all three gate-checkers to deal with fire emergency in underground operations
- In addition to powder-based auto fire suppression system, foam-based AFSS is also being installed in all underground equipment

SUSTAINABILITY INITIATIVES

SK Mine took a major leap forward in furtherance of Hindustan Zinc's sustainability goals during the year.

Energy Saving

Mill-specific power consumption reduced from 31.9 kWh/MT in FY 2020-21 to 31.0 kWh/MT in FY 2021-22 as a result of Variable Frequency Drive (VFD) installation in water pumps

Water Conservation

Recovery of water from tailing dam increased by 10% over FY 2020-21

Emissions Control

- Introduction of Euro-Stage-V engines in underground production vehicles (loaders and trucks), leading to 30% less emissions and reduction in total carbon emission
- Introduction of Fuel Catalyst in HEMMs for UG mine operation to improve fuel efficiency and reduce exhaust emissions; initiative will help improve production performance and simultaneously reduce the carbon footprint

Green Belt Development

- Plantation of 25,000 saplings in and around the mine for eco-system development

Waste Management

- Tailing utilisation increased from 50% in FY 2020-21 to 59% in FY 2021-22 due to better utilisation of paste-fill plants and consistent operation at more than 1,000 hours per month
- Internal waste rock handling increased 46% in FY 2021-22, reducing the environmental footprint at surface

AWARDS & ACCOLADES

Won Gold Medal in National Award for Manufacturing Excellence – 2021, organised by IRIM (International Research Institute for Manufacturing)

Secured 1st Prize in Intra-zonal Mines Rescue Competition – 2022, hosted by Sindesar Khurd Mine under the aegis of Directorate General of Mines Safety - Northwest Zone

Received the Confederation of Indian Industries (CII) - Water Excellence Award for year 2020-21

CASE STUDY

Strengthening the troubleshooting network
DIGITALISING ELECTRICAL SUBSTATIONS TO SPEED UP POWER RESTORATION

Challenged by delays in power restoration in case of tripping, SK Mine undertook automation of substations across 12 of its electrical substations. The digitalisation initiative involved connecting the HT and LT incomer MFR and On/Off signal to the network, so that the connected substation could be accessible from the surface as well as underground.

What prompted the initiative was the challenge faced by the mine in case of power tripping. SK Mine took a root cause analysis approach to minimise the time taken in troubleshooting. With the aim to improve and optimise energy consumption, the team decided to automate all substations for faster troubleshooting and reduce non-working hours due to power tripping.

As part of the initiative, the following measures were adopted:

- OFC-based networking in all surface and UG substations in ring architecture
- Real-time monitoring of HT and LT breaker status and power flow
- Substation SCADA, trend of electrical parameters like: Voltage, Current, Energy, Power, and Power Factor
- Remote operation of breaker

Benefits

As a result of the digitalisation exercise:

- Connected substations are now accessible from the surface as well as underground
- Troubleshooting has been expedited and power reticulation design has been aided
- Improvement in power quality, voltage sag and swell events and root cause analysis
- Both energy consumption analysis and optimisation have improved
- Collectively, these are helping in faster power resumption, leading to reduced loss of operational hours

CASE STUDY

Expanding drill reserves
UTILISING SMOKE HOURS FOR PRODUCTIVE DRILLING WITH NEW-GEN RIGS

Seeing drilling machines lying idle during smoke hours, SK Mine took the initiative for full-scale implementation of automation in all capable drill rigs, to utilise smoke hours for productive drilling. With the aim of getting extra drilling, SK Mine decided to use the new-generation drill rigs, equipped with the capability of single hole automation (down-hole) and fan automation (up-hole).

The idea behind the project was to productively utilise smoke hours, or the time duration provided for clearance of blasting fumes from the mine before re-entry of persons in shift changeover.

As part of the initiative, the following measures were adopted:

- Establishment of Wi-fi network connectivity in advance, along with sensors functionality
- Utilising production drill telemetry data and publishing of reports for machine performance and machine health
- Condition-based maintenance of machines by using telemetry data
- Planning for operator's availability in control room for tele-remote operation
- Provision of IP phone and video calling for better communication
- Tracking of machine over 3D visualisation

Benefits

As a result of the digitalisation exercise:

- SK Mine achieved a sustainable 8%+ metres per month drilling in smoke hours
- The initiative also led to gradual increase in the mine's drilled reserves, besides faster turnaround of stopes
- This is contributing to sustainable mining on all work fronts

RAJPURA DARIBA MINE PERFORMANCE OVERVIEW

The underground Rajpura Dariba (RD) Mine is one of our oldest mines, which commenced operations in 1983. The lead-zinc mine is accessed via decline, main shaft, and auxiliary shaft. We are in the process of augmenting the production capacity to 2.0 Mtpa >> 4.0 Mtpa. The capacity enhancement will be achieved through the introduction of two new portals for upper east and north lode, through further mechanisation and automation.

PERFORMANCE SNAPSHOT

FY 2021-22 was a stepping-stone for Rajpura Dariba mine's capacity expansion on multiple fronts. Ore production witnessed an increase of 3.1% y-o-y, while mined metal production increased by 2.6% y-o-y.

1.25 Mt
Ore Production

5.87%
Grade

48.06 kt
Mined Metal Production

8.63 kilometres
Mine Development

PERFORMANCE UPDATE

Despite the pandemic situation, RD Mine undertook several major projects during the year, commissioning of separate compressor and drilling water line for north lode, besides sump commissioning for M5 block.

- 2nd phase of shaft shutdown, for augmenting the hoisting capacity from 0.9 Mtpa to 1.35 Mtpa
- Commissioned indigenously designed steel structure man-pass – the first-of-its-kind in India
- Commissioned 1.5 Mtpa paste-fill plant

EXPANSION, UPGRADATION & INFRASTRUCTURE DEVELOPMENT

FY 2021-22 saw RD Mine post many new milestones in terms of expansion, upgradation, and infrastructure development.

- Commissioned fully automatic Simba drill machine with CERTIK and RCS facility
- Strengthened the shaft structure by replacing old steel structure & buntons and installing penthouse at inset levels
- Established a benchmark by completing 1,100 metres ramp stripping in record time of 45 days, with strategic implementation and adaptation of open pit bench blasting technique in underground
- Established smoke hour drilling with deployment of technologically advanced drills

EFFICIENCY & PRODUCTIVITY ENHANCEMENT INITIATIVES

A slew of projects enabled RDM to improve efficiency and productivity during the year.

1,100 metres ramp stripping done to incorporate 45T LPDT, leaky feeder infrastructure, and to reduce equipment damage incidents

Expat operator and trainers brought in to operate fully automatic Simba drill machine to improve drilling capacity

Single backfill line installed from surface to 11 mRL, replacing staggered old line

Infrastructural strengthening of mill done to improve operational efficiency and throughput

Replaced main-shaft old cage with new fully enclosed designed cage to improve person safety and skip run hour

SAFETY INITIATIVES

- Introduced underground ambulance by converting LMV
- Old and worn-out penthouse and steel structure replaced at all inset stations
- Replaced main shaft cage with fully enclosed design, improved structural stability and safety

SUSTAINABILITY INITIATIVES

Air Emissions

Installed and commissioned continuous ambient air quality monitoring system to help establish and improve over baseline ambient air quality

Tailing Dam

Introduction of dry tailings and paste-fill plant for optimum utilisation of tailing, reducing tailing discharge to tailing dam (step towards ZLD), and to improve mining condition by reducing overall water intake for underground mining

CASE STUDY

Improving stability & safety metrics
AUGMENTING HOISTING CAPACITY THROUGH INFRASTRUCTURAL UPGRADATION

To strengthen the overall shaft structural stability and safety, and augment the hoisting capacity of the mine, RD Mine initiated infrastructural upgradation and development during the year. A key feature of the project was its Zero Harm execution. The project was supervised by a specialised female expat officer to ensure safe implementation.

The move was triggered by RD mine's decision to enhance its ore production capacity to 1.3 Mtpa in FY 2021-22. RD Mine further plans to ramp-up capacity to 2.0 Mtpa in the next fiscal by increasing the ore hoisting capacity of the shaft from the current 0.9 Mtpa to 1.35 Mtpa, through augmentation of skip speed, payload and running hours.

As part of the initiative, the following measures were adopted:

- Third-party validation of all drawings and designs, and 3D Modelling
- Bolting as part of the structural work, with no welding works
- Exhaustive risk assessment - From design stage to final execution
- Hydraulic torquing in all major foundations
- Upgradation of underground conveyor
- Upgradation of main shaft cage

Benefits

As a result of the structural upgradation exercise:

- Hoisting capacity improved from 0.9 to 1.35 Mtpa
- Pneumatic to hydraulic operation of skip loading station
- UG conveyor output enhanced from 375 to 506 TPH
- Crusher output enhanced from 200 to 440 TPH
- Structural stability and safety in main shaft cage improved

AWARDS & ACCOLADES

Received the CII (Confederation of Indian Industries) - Environmental Best practices award for year 2020-21

CII recognised the development of Biodiversity park at RD Mine as Innovative Environmental Project for the year 2020-21

Won 1st Prize for COVID-19 Awareness at 44th and 45th Mine Safety Week

ZAWAR MINES PERFORMANCE OVERVIEW

Surging ahead on its growth journey, Zawar Mines (ZM) crossed the major milestone of 4 Mt ore production mark in FY 2021-22. This group of four heritage mines, with mining history spanning over 2,000 years, celebrated many iconic achievements during the year. The four underground mines – Mochia, Balaria, Zawarmala and Baroi, also scaled new levels of mechanisation and digitisation. The mines, located 40 kilometres southeast of Udaipur in the state of Rajasthan, successfully harnessed various technological advancements to report exemplary performance during the year.

PERFORMANCE SNAPSHOT

The Zawar Mines touched new frontiers of growth and expansion during FY 2021-22, discovering new lenses and achieving overall milling recovery of 90.80%.

4.41 Mt
Ore Production

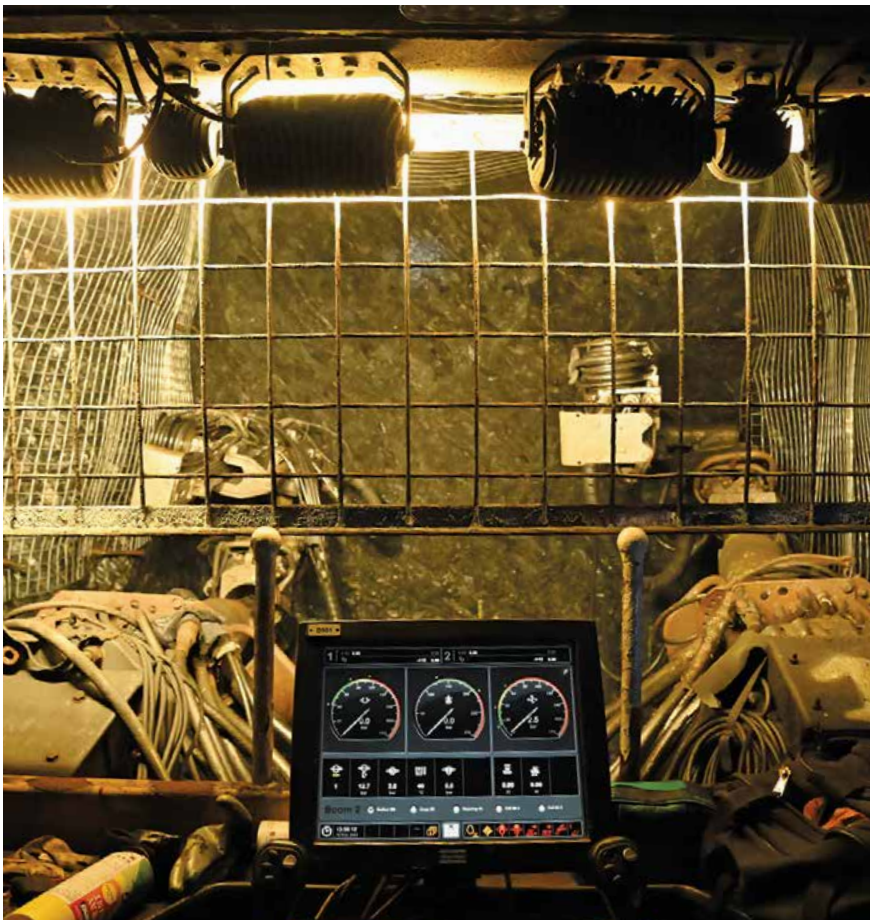
160.51 kt
Mined Metal Production

4.00%
Grade

40.52 kilometres
Mine Development

ZAWAR MINES LAUNCHED SEVERAL NEW INITIATIVES AND CROSSED MANY MILESTONES DURING FY 2021-22:

- Highest ever surface and underground exploration of 210 kilometres
- Conducted successful public hearing for mine expansion from 4.8 Mtpa ore production & ore treatment to 6.5 Mtpa ore production and 7.3 Mtpa ore treatment
- Introduced use of bulk emulsion explosive for blast optimisation, thereby reducing charging time and improving progress in every round of development blast
- Completed Balaria Mine decline to connect lower levels to provide decline access for 63 LPDTs and thereby enhancing mine capacity
- Eliminated track mining at Mochia through decline connection and truck hauling
- Introduction of leaky feeder communication system in all the four mines



Mochia Mine, Baroi Mine and Balaria Mine crossed the highest ever figures for production, development, drilling and MIC during the year.

EXPANSION, UPGRADATION & INFRASTRUCTURE DEVELOPMENT

Zawar Mines continued its efforts to strengthen mine infrastructure during the year.

- Commenced underground back filling operations at Mochia and Zawarmala

EFFICIENCY & PRODUCTIVITY ENHANCEMENT

To further boost efficiency and productivity of the mines, a series of initiatives were undertaken during FY 2021-22.

Establishment of centralised control room at Balaria

Digital enablement of visibility of equipment utilisation for identifying and minimising idling in Mochia and Baroi

Installation of Mine Communication System using Leaky Feeder in Mochia, Balaria & Zawarmala

SAFETY INITIATIVES

- Surface parking infrastructure created at Balaria Mine to eliminate man-machine interaction
- Redesigning of ITMS, mill gate and surface roundabout to avoid traffic related incidents
- Additional maintenance infrastructure created at all mines to ensure availability of safe maintenance area
- Interconnected the underground raise bore at Mochia and Balaria Mines for improving underground environmental conditions
- Mine Fatigue System installed in Baroi

SUSTAINABILITY INITIATIVES

Zawar Mines initiated many significant projects programmes to propel its sustainability agenda.

Introduced first surface and underground electric vehicle

Initiated establishment of 4 MLD Zero Liquid Discharge (ZLD) Plant

CASE STUDY

Digitally-enabled equipment visibility and utilisation

IMPROVING UTILISATION TO MINIMISE IDLING

The losses resulting from sub-optimal utilisation of transportation systems was a cause for concern at Zawar Mines. It was significantly affecting the mine's operating costs and leading to delays in delivery of necessary materials. Poor optimisation of material hauling, and triaging was further resulting in under-utilisation of the trucks and vehicles at the mining site.

Zawar Mines decided to undertake digitisation to enhance the visibility of equipment utilisation, with the aim to minimise the idle time of LPDTs underground.

As part of the initiative, the following measures were undertaken:

- Installation of Vibration Sensors in LPDTs for tracking their activity
- Monitoring of the idle time and performance of LPDTs through a central control room
- Training of control room operator
- Awareness creation among LPDT operators about their performance at the end of every shift

The benefits

- Tracking of different activities (Idle, Off, Active) of LPDTs
- CPH and diesel cost saving through reduction in idle utilisation

AWARDS & ACCOLADES

Zawar is the first mine across Hindustan Zinc to become an ISO 50001 certified location

Presented with Gold Category Award in National Award for Manufacturing Competitiveness (NAMC-21)

Won Platinum Award in Energy Efficiency by Apex India Greenleaf Foundation

5 teams of Zawar Mines won the Par Excellence Award in National Convention in Quality Circle (NCQC)

KAYAD MINE PERFORMANCE OVERVIEW

Located in Kayad, Ajmer (Rajasthan), this underground mine has been delivering a consistent 1.2 Mt of ore with approximately 60 kt of metal in concentrate over the past five years. Our youngest mine, which started operations in 2011, has produced more than 6 lac tonnes of metal content in the past eight years at the back of high level of mechanisation and digitalisation. Ore produced from mine is transported to RA Mine mill, Bhilwara, for beneficiation. Operations are vertically integrated and supported by continuous and integrated surface and underground exploration.

PERFORMANCE SNAPSHOT

In FY 2021-22, Kayad Mine (KM) produced 934 kt of ore, with 44.3 kt of metal in concentrate. With 7.4 kilometres of development in existing and upcoming blocks, it is poised to maintain its current production rate in the coming years.

934 kt
Ore Production

5.23%
Grade

44.27 kt
Mined Metal Production

7.36 kilometres
Mine Development

PERFORMANCE UPDATE

While investing in new infrastructure and development, Kayad Mine also commenced operations on the projects initiated in FY 2021-22 and reported:

- Near surface mining (37 metres) of K1 Block
- Commissioning of electrical substation for auxiliary lens
- Establishment of ventilation circuit in auxiliary lens Section using 3 Vent Raises

EXPANSION, UPGRADATION & INFRASTRUCTURE DEVELOPMENT

During the year, KM successfully established infrastructure and ventilation in auxiliary lens for next year's production. This included:

- Establishment of 3 Raises of 600 metres in auxiliary lens for ventilation
- Development of main sump for auxiliary lens section

EFFICIENCY & PRODUCTIVITY ENHANCEMENT

A slew of innovative measures were undertaken at Kayad Mine to boost efficiency and productivity.

Kayad has successfully shifted to the Mine Development Operator modality, keeping a single stakeholder responsible for core operations

Mine planning teams continually monitor ore yields and methods to further enhance the same through digitalisation and use of advanced technologies to improve operational efficiency. Operations are focussed on ensuring high recovery of ore and minimise the loss of metal, while maintaining operating costs at the lowest possible levels

INSTALLATION OF LEVEL TRANSMITTER AND DIFFERENTIAL PRESSURE TRANSMITTER (DPT) FOR CEMENTED ROCKFILL (CRF) SILOS AND DATA FETCHING IN MINI SCADA

Kayad Mine has installed a Level Transmitter to determine the level to which the silos are filled with cement, that helps to estimate the quantity of cement in each silo. DPT is further being used to measure the flow of cement.

SAFETY INITIATIVES

Kayad Mine implemented a series of new initiatives during the year to augment its safety proposition.

To improve the safety of those travelling underground:

- The braking system of LMVs has been strengthened through installation of positive braking, neutral braking and door parking system
- LVS Type AFDSS and Emergency Stop switches installed on external sides of both passenger compartments (PCs)
- Deadman switches and door parking interlock have been installed in PCs and RBOs
- Stretchers have been provided in both PCs
- Joint rescue operations conducted by Kayad Rescue team alongside National Disaster Rescue Force that helped to save one precious life at Opencast, Talc Quarry

To increase the life of LHD bucket, the DMAIC methodology has been implemented with the aim to reduce the overall COP of KYM.

This has enabled:

- Consumption optimisation
- Minimisation of bucket repairing and fabrication cost

TRAINING INITIATIVES

Skill Assessment

To identify areas for improvement, a robust skill assessment exercise of Kayad mine's executive employees was undertaken during the year under review. Based on the assessment, a training calendar was prepared to ensure skill gap mitigation for all manpower at the site. Further, to boost productivity, and to assess the safety and operational improvement areas, a skill mapping and assessment exercise was also carried out for contract workers.

Special Training

A special training programme on Cracking FCMM Certifications was held with the support of an expert former government official. Barring two, all participants passed the exam, aimed at building a robust talent pipeline.

6-day Extensive Training Programme for mining mates

This was conducted by ex DDG, DGMS, to improve the competency levels of mining mates with respect to their roles, responsibility, hazard identification and risk assessment.

SUSTAINABILITY INITIATIVES

In line with its concerted focus on sustainable development, Kayad Mine took various measures during the year to ensure the following:

- Maintenance of Zero Liquid Discharge
- Specific water consumption at 0.027 m^3/MT against target of 0.030 m^3/MT
- Treatment of wet/food related waste in organic compost machine
- Control of fugitive emissions with road sweeping machine and water spray

Solar Panel Online Data Monitoring via SCADA

Kayad Mine is monitoring real-time power generation and consumption metrics, along with other critical working parameters of all inverters. Solar site monitoring is done using a specialised camera to assess the physical conditions at the site, besides ensuring upkeep to avoid any interruption to the operations.

AWARDS & ACCOLADES

Won the 'National Safety Award' for FY 2019-20 and FY 2020-21 from the Ministry of Labour and Employment, Government of India

Received '5 STAR RATED MINES' Award from the Ministry of Mines, Government of India

Conferred with the 'Golden Peacock Environment Management Award-2021'

Achieved 'FIMI Award of Excellence in Environment', Safety & Health

Received 'Par Excellence' category award in ICQC-2021 Six Sigma project on Improvement of Fill Factor

Received 'Par Excellence' category award in NCQC-2021 for 5S & Six Sigma projects

Received 7 awards in different categories in '34th Mine Safety Week, 2021'

SECURING THE WORKFORCE AMID COVID-19

In line with our people-centric philosophy, we, at Hindustan Zinc, have put in place several protective measures to keep our employees and business partners safe and secure amid the COVID-19 crisis. We had launched a host of programmes and initiatives when the pandemic first broke out in India. During FY 2021-22, we further strengthened the safety network and expanded the ambit of our initiatives.

- We implemented a well-articulated COVID-19 Management Plan with the help of a Special Task Force (STF), which ensured field execution and helped organise awareness sessions
- A COVID-19 helpline centre was developed for connecting infected employees and business partners with their families
- A team was deployed 24x7 with a well-established control room at colony premises
- For smooth running of mine operations, special arrangements were made for dedicated isolation centres at hospital with 30-bed capacity and at DAV school with 100-bed capacity
- A mega COVID vaccination drive was carried out for our employees, business partners, family members and villagers in the eligible age group
- We tied up with a private lab for COVID-19 RTPCR testing with home collection of samples, and with a hospital for handling exigencies
- A thermographic camera and mask detection system was installed at the biometric gate to ensure regular temperature screening and adherence to the mask mandate; face masks, face shields and hand sanitisers were distributed among employees and in the community
- A 24x7 medical facility is in place for regular check-ups at first-aid stations and hospitals
- Periodic disinfection and sanitisation of offices, workplaces and the surrounding community areas was undertaken during the year
- Vaccination certificate is made mandatory for all consultants and service engineers for entry onto Hindustan Zinc premises
- During the peak of infections, provisions were made for social distancing, with all meetings and discussions managed through virtual platforms. There was no outside travel, restricted entry to mine, immunity boosting doses and regular sanitisation
- To support all COVID-19 recovered employees, we organised management classes and virtual breathing sessions

LOOKING AHEAD

- Enhance Reserves and Resources to sustain ore production with the use of advanced technology, including Artificial Intelligence and Machine Learning. The same is deployed to identify new ore blocks and improve the detail of existing blocks thereby leading to better targeting
- Enable growth in operations by investing in development of newly discovered lenses; establish the required infrastructure to boost ore production; and overall secure better grades and higher metal in concentrate production in the years ahead
- Sharp focus on reducing energy consumption and augmenting renewable energy generation
- With the vision to reduce our environmental footprint, our focus will be to further progress on our journey of dry tailings project
- Deploy Battery Electric Vehicles (BEVs) for underground operations to facilitate underground services such as Shotcreting Equipment and Explosive Charging as well as production equipment such as loaders and trucks. This will support our vision to reduce carbon emissions, improve ventilation and thereby provide a better working ambience
- Strive to migrate all production vehicles to Euro-Stage-V Engines by 2025
- Sustain efforts to further reduce cost with increased use of digitalisation and mechanisation, thus leading to better operational efficiencies
- Progress on digitalisation efforts across the mines, including laying of optical fibre network to set-up a high bandwidth underground Wi-fi network, enable Smart equipment to communicate with the mine control room and monitor all equipment health parameters directly from mine control room, all of these will help to augment productivity and reduce cost