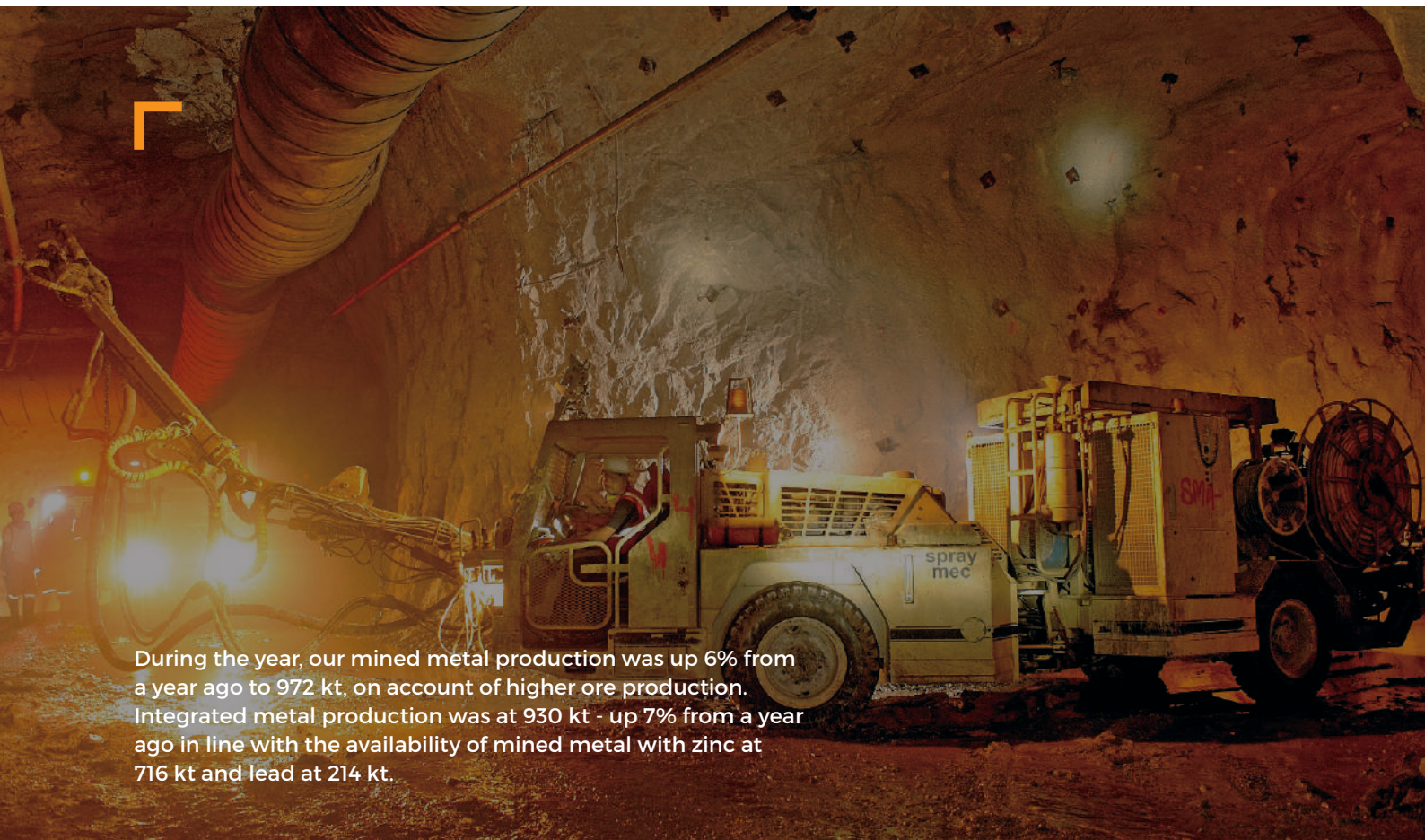


Mines

Performance Overview

With sustainable operations at the core of our Mining business, we remained resolutely focused on making our mines more efficient, safe and productive. FY2021 saw Hindustan Zinc report the highest ever ore production, supported by proactive mine planning and backed by increased technology use and better targeting.



During the year, our mined metal production was up 6% from a year ago to 972 kt, on account of higher ore production. Integrated metal production was at 930 kt - up 7% from a year ago in line with the availability of mined metal with zinc at 716 kt and lead at 214 kt.

Rampura Agucha Mine (RAM) Performance Overview

The second largest zinc mine in the world, the Rampura Agucha Mine stands apart as a massive world-class ore body with zinc-lead reserve grade averaging 13.4%. This stratiform, sediment-hosted, high grade zinc and lead deposit mine posted record-breaking productivity during the year at the back of increased operational efficiencies.

4.3 Mt

Ore production up 9% Y-o-Y

453 kt

MIC production up 9% Y-o-Y

(As of FY2021)

Delivering Operational Efficiencies

The year saw RAM make notable progress on enhancing operational efficiencies through better management and focused initiatives to boost savings. Some of the highest ever operational milestones achieved at the Rampura Agucha Underground Mine that represent to showcase our performance efficiencies and productivity include:

- Mine backfilling/pastefilling of RAM at ~1.4 mn cum
- Mine production drilling of ~555 km
- Mine exploration drilling of 23.5 km
- Mine development of 3,074 m achieved in a month
- Consumption of fly ash as binder in pastefilling, resulted in direct reduction of cement consumption
- Achieved production drilling of 10,728 m in a single month with one solo (production drill machine)
- Successful installation of online gas monitoring system at UG Workshop
- Chiller unit commissioned below -290 mRL North to supply air quantity of 36 m³/sec

With the successful commissioning of Ore Pass 3, the shaft can now be utilized for hoisting ore. The underground crusher can be utilized for increased crushing capacity, while tracks can be used further for waste hauling.

Shaft Gets New Edge

A slew of measures at the Rampura Agucha Shaft unleashed a series of benefits for the Mine during FY2021.

Shaft Integration with Decline achieved in February 2021

Ore Hoisting from Rampura Agucha Shaft initiated in March 2021

293 TPH High Density Thickener successfully commissioned at RAM in March 2021

Lateral development for Crusher-2 completed and erection of Crusher-2 initiated

New Connection. New Efficiencies.

With the completion of the connection of North Decline to shaft bottom, a ~8.9 km decline has been successfully created, enabling enhanced hauling capacity of the mine. This will lead to quicker manpower transportation and better maintenance of machines. Other benefits include additional fresh air to bottom levels in the north section as well as additional mining fronts to boost development and volume.



Setting New Benchmarks in Safety

With safety central to our mining operations, we introduced several innovative initiatives to enhance the safety quotient at RAM.

First-of-its-kind Underground First Aid Station in India Developed

The station is equipped with advanced medical apparatus to provide critical life-saving support for immediate underground first-aid facility. It is manned 24X7 by trained rescue personnel to aid emergency cases.

Underground Man-pass Successfully Commissioned

RAM's first man-pass (from -255L to -280L North) will enable secondary evacuation passage at the time of any emergency in the mine.

Rampura Agucha Mine Received Platinum Award at ICQCC

A case study presented by Hindustan Zinc's team on upgrading line of sight to tele-remote production bogging for improved safety.



Taking the Digital Leap

Digitalization at RAM got a further push during the year with the implementation of several advanced initiatives:

- 10 Km mine Wi-Fi network established
- Online health monitoring of HEMM equipment
- Live tracking of equipment on 3D map
- Fill factor monitoring via load scanner
- Monitoring of substations via CCTV camera

Raising the Bar Higher

Taking on the challenge of improving the annual recovery of Pb & Zn Ore from the previous fiscal's levels of 52.56% and 87.36% respectively, the RAM team tried to identify issues that could be a barrier to increasing recovery.

The team found the root cause to lie in:

- High pH of Ore to mill due to paste dilution
- Reduced susceptibility of reagents due to deterioration in water quality used in reagent preparation
- Inability to maintain Ore blending & healthy COSP due to less production

To improve the metallurgical performance & increase recovery, the team identified and implemented the following solutions at the plant:

- Dozing of Sulphuric acid in lead circuit to reduce pH for improved Pb flotation kinetics
- Preparation of Nigrosine in soft water
- Reagent preparation in fresh water to improve reagent susceptibility
- COSP building/Ore blending to minimize frequent mill start-stops & reduce feed variation

These interventions resulted in surge in recovery of zinc, lead and silver, which in turn translated into higher MIC figures for all three in FY2021.

- 2% improvement in zinc recovery, followed by generation of additional 8,300 tons of Zn MIC
- 4.5% improvement in lead recovery, followed by generation of additional 2,750 tons of Pb MIC
- 1.5% improvement in silver recovery, followed by additional generation of 5 tons of silver MIC due to increase in Pb recovery

Best Practices Implemented

Installation of energy-efficient blower in Stream-1 to reduce power consumption by 0.5 kWh/ton

Reduction in Specific Power consumption in Stream-4 by 4 kWh/ton

Implementation of IoT-based energy management system at Paste Fill Plant leading to 0.5 kWh/m³ reduction in power

Online condition monitoring system for SAG Mill & Ball Mill gear boxes to improve reliability

Health Assessment Study of 132 kV Overhead line of RAM from 220 kV Gulabpura Substation

Replacement of conventional wooden door by Emergency Exit Fire Door with Panic Exit device as per IS 3614

Repairing of concrete reinforcement of Pb, Zn & Tailing thickeners to ensure structural and equipment safety

Kayad Mine Performance Overview

The captive unit of Rampura Agucha cluster of Hindustan Zinc, the Kayad Mine has been delivering a sustained ore production rate of 1.2 Mtpa since its capacity was ramped up to its full potential in FY 2017-18, just three years after regular production commenced in June 2014.

2.63 Mt

Reserves

(As of 1st April, 2021)

7.7%

TMC

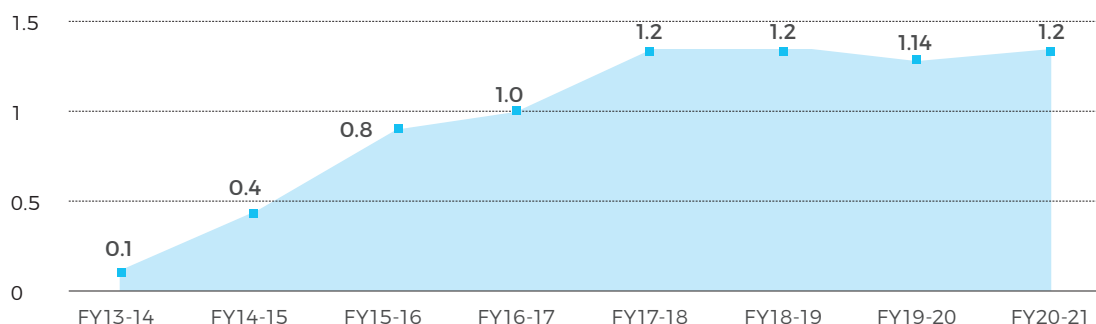
Getting Greener & Better

In line with the Company's strong focus on Environment, Health and Safety, the Kayad Mine witnessed major initiatives and interventions to enhance its Green footprint and augment its safety quotient, with increased productivity and efficiency.

- Solar power plant of 1 MVA capacity commissioned to generate Green energy and reduce carbon emission
- Vertical Sprinkling in Water Sprinkler for dust suppression in Underground



Ore Production (Mt)



Becoming Safer & Smarter

A series of novel safety and digitization initiatives during the year helped further scale-up the safety, operational efficiency and digital standards of Kayad Mine. Realizing the importance of skill upliftment of underground workers for ensuring safety and performance optimization in mining, we have set up a Training Gallery at the Vocational Training Center.

- Combating COVID-19: To combat the worldwide pandemic, at Kayad mine, we implemented thermal screening of all employees coming on duty and ensured proper sanitization. There was no major COVID-19 impact on business due to robust planning, execution, care & precaution.
- Digitalization in Cement Silo: Installation of Level Transmitter and Differential pressure transmitter leads to:
 - automatic and mechanized backfilling of void in UG
 - overrunning of compressor and optimized cement consumption
 - blocking of fugitive emission of cement, thus ensuring safe and healthy environment
- Reliability enhancement of TH430 model 30T Trucks: Electro-magnetic retarders installed to enable speed control while going down the ramp, enhancing the life of the axle and safety
- Installation of extended beacon light for better visibility of all LMVs to avoid man-machine and machine-machine interaction
- Three-second delay barrier and motion sensor at pedestrian pathways for signaling to person moving in junction area to avoid man-machine and machine-machine interaction.
- To deal with emergency in mines, stench gas was installed at the mine portal entry to evacuate people to fresh air in the event of an emergency at UG
- Provision of biometric access control in Electric Overhead Traveling crane (EOT) to prevent unauthorized operation
- Kayad Quality Team-SmartQ won cluster level and participated in Hindustan Zinc Level Infinity 2.0 CI Convention-2021

The Winning Streak Continues...

- 1 Ranked 1st in overall performance in 30th MEMC week in Underground Mine category.
- 2 Kayad Team won in the highest category "**Par Excellence**", for its DMAIC project "**Improvement in Fill Factor**", at the 34th NCQC-2020, organized by QCFI under Allied Concepts category, thus becoming eligible to participate at **International Level ICQC-2021**.
- 3 Kayad Mine received "**State level BHAMASHAH award**" for exemplary CSR work in Education.



Rajpura Dariba Mine Performance Review

Operational since 1983, the old underground zinc-lead Rajpura Dariba Mine (RDM) crossed the 1.2 Mtpa ore production milestone in FY 2020-21. This was a notable achievement as the Mine stayed aligned with its Vision to double its ore production even amid the COVID-19 crisis. Successfully overcoming all challenges, RDM, with its multiple production centers, continued to scale new levels of automation and mechanization during the year to stay on course of its growth charter.

1.2 Mt

Ore production
up 17% Y-o-Y*

47 kt

Mined metal
production up 5%*

(*As of 1st April, 2021)

Boosting Productivity

Ore production at RDM touched an all-time high during the year, with record production drilling.

A series of innovations led to increased productivity and steady growth for the mine.

- Introduction of shotcrete for dealing with poor ground, civil work and barricade construction, thus leading to improvement in overall productivity
- Installation of new equipment, including grader, water cannon, MinCA, Spraymec and Miller, to achieve higher production targets
- Commencement of production from new Blocks - EU3, NL2 & M5
- Implementation of triple tube for UG exploration drilling led to 70% increase in ore recovery

Enhancing Efficiency

The growing focus on sustainable growth translated into further enhancement in efficiencies and safety at RDM during the year. The following measures contributed to this improvement.

- Introduction of Charmec and Bulk emulsion explosive for blast optimization thereby reducing charging time and improving progress in every round of development blast
- Commissioning of 1,000 cfm surface compressor at 2060N to improve compressed air flow for drilling machine thereby reducing running hours of existing compressors
- Commissioning of Underground Workshop at -87 mRL for maintenance of equipment and reducing hauling of 6 km to surface



Execution activities were launched during the year for combined paste-fill and Dry Tailing Plant at Rajpura Dariba, which will help in increasing ore production from 1.2 Mtpa to 2 Mtpa. This will also facilitate additional utilization of tails by ~20% for back-filling, and will reduce stope turnaround time.

Shaft upgradation capacity from 0.7 to 1.35 Mtpa is planned in FY2022 H1 where skip freeboard will be optimized bringing back skip cycle from 30 to 40 skip per hour.

- Completion of Phase-1 shaft shutdown to enhance skip capacity and structural strengthening in journey of shaft upgradation from 0.7 to 1.35 Mtpa
- Strengthening of Ball Mill Main foundation, with the 750m² grating replaced in mill thereby improving HSE
- Introduction of table-top XRF metal analyzer for improving mill metal recovery by around 0.25%.
- Implementation of Fibre-reinforced shotcrete barricade for backfilling, thereby improving stope cycle and development saving of around 50m per annum

Sindesar Khurd Mine Performance Overview



With its current capacity of 6 Mt, the world-class silver-rich Sindesar Khurd Mine (SKM) is the largest underground mine in India. A key contributor to the Company's integrated zinc and lead production and the prime mine for its silver portfolio, SKM is one of the lowest cost lead and zinc producers in the country. The mine delivered sustained performance even amid the COVID-19 pandemic, at the back of its operational and cost efficiencies.

4.8 Mt

Ore production

257 kt

Total Mined Metal Production

(As of FY2021)

Continuous expansion and technological advancements have made it the most mechanized underground base metal mine in the country. Apart from the Main Lens, the mine also consists of multiple standalone deposits, or auxiliary lenses, thus constituting multiple standalone production centers.

The Smart Edge

An early adopter of new technologies, SKM has expanded its digital footprint further to introduce a new digital way of working with the vision to increase its Overall Equipment Effectiveness by 20% during the year as part of its digitalization program – Drishti. The mine has been equipped with an optical fibre network, which was extended to a Wi-Fi enabled network for use by various utilities. This high bandwidth Wi-Fi network supports a data transfer rate of 10 GBPS. SKM has also recently commissioned an Integrated Control Room for mine and beneficiation plant operations from a single room.

Minimizing Jamming

By tracking its assets inside the mine using Wi-Fi tags and LASER scanner-based positioning system, SK Mine achieved significant reduction in shift-hour breakdowns to cut down on jamming issues. The average response time to clear jamming issues also reduced by 40%. The control room played a major role in tracking daily operations and critical processes.

Predictive Maintenance

OPTIMINE analytics and sustained efforts of SKM's digital task force made it possible to predict failure of engine, brake, transmission, retarder and engine cooling system. Shift wise predictive maintenance activities were performed, thus reducing the breakdown hours of Loaders and Trucks. This led to significant improvement in availability of these machines at the mine.

The Performance Edge

FY2021 saw SKM sharpen its performance edge with several new initiatives to drive efficiency. The result:

- Mine achieved its highest ever monthly mine development (2,200+ meters) in January 2021
- Paste filling established at 1,000+ run hours monthly in Q2; tailings utilization went up to 73%
- Mine reported global benchmark performance of operating 1,095 Hours of Paste Fill Plants in October 2020
- 90.8% lead recovery achieved in July 2020; remarkable improvement in beneficiation process
- Mine ventilation capacity enhanced from 850 m³/s to 950 m³/s
- Ore production commenced from auxiliary lens SKA1
- Short Interval Control (SIC) established in operational planning to leverage technology in day-to-day activities of planning, scheduling and tracking
- Achieved Highest Asset Optimization Score across mining units of Hindustan Zinc
- Reduction in cement consumption norms, with enhanced utilization of Fly Ash in Paste fill recipe
- Successfully extracted crown pillar stope with better recovery than planned

During the year, the Graphite floatation system was commissioned at Mill 3 of Sindesar Khurd Mines, which will enhance the smelter throughput and boost recovery.

Setting A New Benchmark

How We Enhanced Operating Hours at Paste Fill Plants

Carrying forward its efforts to challenge the status quo and set new industry benchmarks, the SKM team successfully achieved running operations of more than 1,000 hours consistently in both its Paste Fill plants, thus resulting in significant reduction in underground voids.

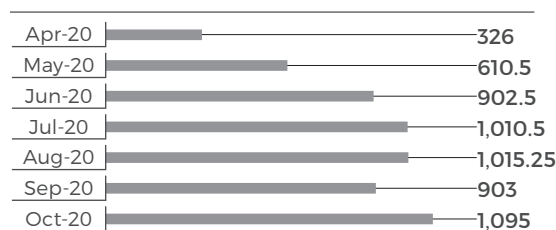
The team, comprising members from plant and underground, used DMAIC methodology for process improvement. (**Define:** identify the opportunities for improvement; **Measure:** identify current performance; **Analyze:** identify root causes for gaps/problems in performance; **Improve:** identify possible solutions and implement, and **Control:** maintain the gains that are achieved.)

Post analysis, the team identified the following **key initiatives:**

- Detailed advance back filling planning for next three months and ensuring availability of stopes (three stopes at a time for both paste plants)
- Commissioning of new pipe handler, with pipe handler and one XL to be deployed only for paste filling pipeline work
- Installing diverter valve in UG for changeover to increase availability
- To maximize filling, throughput all bore holes with minimum diameter of 254 mm
- Changes in internal pipeline (MOC) to trellex pipeline, in order to reduce leakages in plants
- Maintain critical spares for PD Pumps, Filters, Vacuum Pumps & Pumps
- Mixer Discharge Chute modifications & vibrator installation, to avoid frequent chute jamming
- Installation of online greasing system in both mixers.
- Schedule maintenance plan for paste plants during curing time of underground stopes

The Result

Operating hours increased to a record 1,095 Hours in October 2020.



Zawar Mines Performance Overview

The highest ever growth in ore production and mine development marked a new milestone for Zawar Mines (ZM) during FY2021. This group of four reserve and resource heritage mines – Mochia, Balaria, Zawarmala and Baroi – have an average zinc-lead reserve grade of 4.70%. Regular reserve upgradation has led to increase in reserve from 14.5 Mt to 31 Mt by March 2021.

3.9 Mt

Ore production
up 21% Y-o-Y

(As of FY2021)

151 kt

MIC production
up 20% Y-o-Y

Ore production capacity at ZM is planned to be increased progressively to 5.2 Mtpa by FY2022. Based on R&R potential, the vision is to take it up to 6.5 Mtpa by FY2024.

Zawar Mines, Baroi Mines and Mochia Mines crossed the highest ever figures for Production, Development, Drilling & MIC in a month during FY2021.

First female mine manager at Zawarmala was inducted into the team.



Raising the Efficiency Bar

Extensive Innovation and judicious deployment of technology pushed up the efficiency bar at Zawar Mine during FY2021. A look at some of the innovations and technological interventions:

- Backfill (Hydro fill & Paste fill) plants commissioned at Mochia and Zawarmala mines, respectively, to improve Mining Ore Recovery and global stability
- Obtained Environmental Clearance for 4.8Mt of Ore Production & Ore Beneficiation for Zawar Group of Mines
- Started opening up the New Mining Block “Purvanchal” at Balaria Mine
- Discovered new lenses at shallow depth (Western lenses at Zawarmala Mine and South Baroi lenses at Baroi Mine)
- Completed Balaria mine decline to connect lower levels to provide decline access, mine capacity enhancement and additional outlets
- Achieved more than 98% auto production booking system compliance
- Installed Feeder Monitoring System (FMS) for notification of tripping, over mobile, in view of the complex power distribution at Zawar Mine
- Introduced Power saving initiatives, resulting in the reduction of GHG emissions by more than 10K ton CO₂
- Complete transformation of Zawar Mine from conventional to mechanization
- Voice communication system installed & commissioned at Zawarmala, Baroi & Mochia
- Integrated the voice communication system with IP phones at all four Mines, Mill & Surface



With the commissioning of the Backfill plant at ZM, the use of tailings in backfilling will go up, thus in turn increasing the life of the tailings dams. The commissioning of backfill plants at Zawarmala and Mochia mines will de-risk operations and provide opportunity to mine left-out high-grade ore in pillars.

Growing Sustainably & Safely

ZM's growth trajectory FY2021 mapped significant progress on the critical yardsticks of sustainability and safety.

- › Commissioned the Mill Link Road along with truck parking, to minimize man-machine interaction
- › Completed the layout upgradation and pedestrian path at Mochia Portal
- › Installed & commissioned additional 150 cum/sec ventilation fans at Balaria for improving Mine environmental conditions
- › Interconnected Underground raise bore at Mochia & Baroi Mine for improving underground environmental condition
- › Commissioned central HSD filling station at DG set and established HSD filling station at Baroi Mine
- › Inducted key service equipment for UG to make operations safe
- › Upgraded the oil handling infrastructure at all sites and at the central store