



# JNARDDC

Jawaharlal Nehru Aluminium Research  
Development & Design Centre

Autonomus Body Under Ministry of Mines, Government of India

REUSE

REDUCE

RECYCLE



# ANNUAL

## REPORT 2023-2024

In the service of the Aluminium Industry  
Promoting – Recycling and Startups



# ANNUAL REPORT 2023-24



**JNARDDC - ISO/IEC 17025:2017 & ISO-17034:2016 NABL Accredited Lab**

**Jawaharlal Nehru Aluminium Research Development & Design Centre**

**Autonomous Body under Ministry of Mines, Govt. of India**

**Amravati Road, Wadi, Nagpur – 440023**

**[www.jnarddc.gov.in](http://www.jnarddc.gov.in)**

## CONTENTS

FROM DIRECTOR'S DESK.....	03
ABOUT JNARDDC .....	05
OBJECTIVES OF THE CENTRE.....	06
VISION &MISSION STATEMENT.....	06
RESEARCH AREAS.....	07
RESEARCH FACILITIES .....	08
PROJECTS COMPLETED .....	09
ONGOING PROJECTS .....	24
COLLABORATIVE WORK.....	29
PATENTS FILED / GRANTED .....	34
TECHNICAL PAPERS PRESENTED / PUBLISHED & CONFERENCES .....	35
EVENTS.....	39
AZADI KA AMRIT MAHOTSAV.....	50
TRAINING PROGRAMS.....	52
AWARDS / ACHIEVEMENTS .....	53
ORGANISATION CHART.....	55
GENERAL BODY MEMBERS .....	56
GOVERNING BODY MEMBERS.....	57
RESEARCH ADVISORY COMMITTEE .....	58
PROJECT MONITORING COMMITTEE.....	59
SCIENTISTS AND STAFF .....	60
NEW EQUIPMENTS / FACILITIES OF JNARDDC.....	61
ANNUAL ACCOUNTS 2023-24.....	64

## From Director's desk



I have the pleasure of presenting the 35<sup>th</sup> Report of Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDDC), Nagpur for the year 2023-24. With the dedicated efforts of our scientific & administrative workforce, we have completed seven projects of S&T(Mines), DST and NALCO worth ₹4.03 crores. The Centre is executing eighteen projects of Science & Technology (Mines), Ministry of Coal, NITI Aayog, NALCO and other parties. Furthermore, several new projects were proposed to various agencies.

While carrying out the above R&D work, the Centre achieved revenue generation (IEBR) of ₹ 23.69 crores. Our scientists have published/presented 31 papers in national and international journals/conferences and secured four patents.

JNARDDC continued its pro-active role in assisting the nation's think tank NITI Aayog through Ministry of Mines for framing of EPR policy guidelines in consultation with MoEFCC. The other recycling activities include (i) Setting up of Centralized Dross treatment facility (Aluminium) (ii) Laying down process standards for scrap recycling Products (iii) Laying down Minimum Infrastructure Requirement for recycling units (iv) Develop performance indicators and a mechanism for ranking and evaluation of units in coordination with MoEF&CC and other stakeholders (v) Developing a mechanism (website) by JNARDDC for registration of segregators, dismantlers, recyclers, collection centres and all involved stakeholders and (vi) Preparation of Vision Document on Circular economy in non-ferrous metal sector.

JNARDDC along with MRAI (Material Recycling Association of India), NALCO, NMDC & MSTC conducted 75 major circular economy campaign events all over the nation on the occasion of Azadi Ka Amrit Mahotsav to commemorate the 75<sup>th</sup> year of India's independence –The program focused on sustainability in Ferrous and Non-Ferrous Metals (Aluminium, Copper, Lead, and Zinc). It also included awareness programs in 22 ZP schools of 11 districts of Vidarbha and 5 engineering colleges of Nagpur.

JNARDDC is assisting BIS, Bureau of Indian Standards for standards for upgrading and formulating the guidelines for Al-scrap and Standards for aluminium alloys.

JNARDDC is also the sector expert for the aluminium sector under the PAT-2 /3 (Perform, Achieve & Trade) Scheme in the National Mission for Enhanced Energy Efficiency (NMEEE) under the Climate Change Project for Bureau of Energy Efficiency (BEE), Ministry of Power

The Centre has been nominated as the implementing agency for promoting startups and MSMEs through the S&T- PRISM program. Under S&T PRISM 1.0, a total of five startups and MSMEs were awarded grants with a view to promote the startup and MSME sector in 2023-24.

With diversification in coal characterization facilities and commendable performance as a referee lab for third-party coal sampling, the institute was able to achieve its all-time high internal revenue generation till date.

We acknowledge the support extended by the Ministry of Mines, General Body, Governing Body, Research Advisory Committee, Project Monitoring Committee, all the scientists and staff of the Centre, various aluminium industries (especially NALCO), as well as others (GSI, MECL, OMC, CIMFR, QCI etc.).

We are pleased to announce the launch of a new recycling division at JNARDDC, a significant step towards embracing the principles of a circular economy and sustainability. As the world shifts its focus towards eco-friendly practices, India is poised to play a vital role in this transformation. Our new division will spearhead efforts to promote recycling and waste utilization, specifically targeting the non-ferrous metal recycling industry. This initiative will not only contribute to a cleaner environment but also unlock new opportunities for innovation, job creation, and economic growth. By harnessing the potential of waste materials, we can reduce our ecological footprint, conserve natural resources, and create a more sustainable future for generations to come.

The new recycling division at JNARDDC is committed to driving positive change and promoting a culture of sustainability. We look forward to collaborating with stakeholders, industry experts, and the community to make a meaningful impact and foster a greener tomorrow.

Dr A Agnihotri  
Director

## About JNARDDC

Jawaharlal Nehru Aluminium Research Development and Design Centre, Nagpur is a “Centre of Excellence” set up in 1989 to provide a major R & D support system for the emerging modern aluminium industry in India by undertaking basic and applied research in the areas of bauxite, alumina and aluminium. It is a Rupees 35 crores joint venture, supported almost equally by the Ministry of Mines, Govt. of India and UNDP. The Centre is in its own sprawling campus just outside the orange city of Nagpur and became fully functional since 1996. With serene surroundings and housed in a modern technical complex with state of art equipments, provide just the right atmosphere for the scientists of the Centre to make creative contributions to the technological growth of the Indian aluminium industry. JNARDDC, a Central Government autonomous body of Ministry of Mines is registered under Societies Registration Act, 1860 (455/87-Nagpur dated 13.8.1987) and Bombay Public Trust Act, 1950 (F-6778-Nagpur dated 8.10.1987) as a Trust.

It's an ISO/IEC 17025:2017 and ISO:17034:2016 NABL accredited Lab and is recognized as a Scientific & Industrial Research organization by the Department of Scientific & Industrial Research, Ministry of S&T, Govt. of India. It is the only institute of its kind in India pursuing the cause of R&D from bauxite to finished product under one roof for the growth of aluminium Indian industry. The Centre with its limited and highly qualified manpower has developed a brand image for providing quality technical support services to primary and secondary aluminium industries. JNARDDC has made key contribution in the areas of beneficiation, characterization, technological evaluation, up-gradation of bauxites, reduction of energy consumption & environmental pollution, by effective utilisation of aluminium industry residue materials such as red mud, dross & scrap etc and process modelling for the benefit of aluminium industry and the nation. It's one of the most renowned labs for providing analytical testing services and has ventured into recycling in non-ferrous sector.

The Centre also offers analytical and testing facilities to other non-ferrous industries, steel plants, small-scale industries, R&D organisations, and academic institutions particularly in the areas of chemical and mineralogical analysis, powder characterisation, thermal mapping, micro structural studies, mechanical and non-destructive testing, failure analysis and technical information.



- To assimilate and adapt the technologies suitable for raw materials available in India to produce alumina and aluminium and to develop indigenous know-how and basic engineering packages for future alumina and aluminium plants to be set up in the country.
- To undertake research programs especially in the area of reduction in material and energy consumption and to provide analytical services to the industries.
- To set up and operate data banks in the areas of bauxite, alumina and aluminium production for the benefit of the industries.
- To provide training to the personnel employed in the Indian aluminium industry through organization of workshops, seminars and group training programs.
- To provide technological assistance to the secondary aluminium industry especially in the areas of downstream processes and wastes recycling.
- Promotion and development of the recycling industry and transition to a circular economy in the Metal sector

To be renowned nationally and globally as primary research hub for all aluminium products and processing



To undertake innovative research projects for providing complete technological solutions to meet the challenges for sustainability of aluminium industry



## Research Facilities

### Bauxite & Alumina Division

- Large Scale Alumina Laboratory
- Laboratory autoclaves, 1, 5 & 10 Litre capacity
- Bomb Digesters & Total Organic Control (TOC)
- Low Temperature bath equipment
- Equipment for Precipitation Tests
- Angle of repose apparatus & Brick making unit
- Potentiometric Titrator
- Universal Impact Mill
- TLC Sample Spot Applicator
- Optical Scanning Densitometer
- Petrological Microscope
- Rotary & High temperature sintering furnace
- Lab flotation machine & Hydrocyclone test rig
- Granulating instrument
- Wet High Intensity Magnetic Separator
- Laboratory Ferrous Wheel Separator
- Rotap Sieve Shaker
- Bond Mill Index
- Density Instrument
- Halogen Moisture Analyzer
- Gravity concentration/ shaking table

### Analytical Division

- Classical Wet Chemical Laboratory
- X-ray fluorescence (XRF)
- X-ray Diffraction (XRD)
- Inductively Coupled Plasma- Optical Emission Spectrometer (ICP-OES)
- Inductively Coupled Plasma- Mass Spectrometer (ICP-MS)
- Glow Discharge Optical Emission Spectrometer (GD-OES)
- TGA- Moisture, VM, LOI Analyzer
- Bomb Calorimeter
- Humidity Chamber & Muffle Furnace
- Flame Photometer
- Double beam UV Visible Spectrophotometer
- Microwave Digestion System
- Ultrapure water Purification System
- Fusion Bead making Machine
- Pellet making Machine
- Nano-Milling Machine & Spin Coater
- Bench scale poly aluminium chloride unit
- Sulphur Carbon Analyzer

### Downstream Division

- 100 kN Universal Testing Machine
- Scanning Electron Microscope +EDS & EBSD
- Vicker's hardness Tester
- Induction Melting & Heat treatment Furnace
- Metallurgical Microscope + Image analyzer
- Resistivity / High Precision Micro Ohm Meter
- Digital Rockwell & Brinell Hardness Tester
- Ultrasonic flaw detector
- Electro polishing machine
- Conductivity meter & Roughness meter
- Milling machine
- Hyperextrude software
- Extrusion modeling and simulation
- Anodizing lab
- Erichsen cupping test
- 14 MN Extrusion Press
- IR Pyrometer
- Inverted light microscope
- Laser marking machine

### Aluminium Electrolysis Division

- Specific Surface Area analyzer
- Mercury Intrusion Porosimeter
- Helium Pycnometer
- Thermal Analysis System, (TG & DSC)
- Specific Electrical Resistance (Anode)
- Mettler Softening Point Equipment
- Infra-Red Thermography
- Three Axis Magnetometer & Gauss meter
- Computer controlled Potentiostat / Galvanostat
- Thermal Conductivity Meter
- Photoacoustic Spectrometer (PFC Instrument)
- Data Acquisition and Processing System
- Heat Flux Meter
- Liquidus temperature measuring kit
- Lab Mixing and Kneading Machine
- Mathematical modeling

## Projects Completed in 2023-24 : 7 nos.

*P-61: TPN:59025 Instrument for Real-time measurement of anode current distribution of aluminium electrolysis cell: DST, New Delhi*

### **Objective**

To develop a Wi-Fi enabled real-time anode current distribution measurement system for aluminium electrolysis cell.

### **Background:**

A Wi-Fi enabled system for continuous monitoring of the anode current is developed based on the principle of anode rod equidistant voltage drop sensing. The developed system is capable to measure the individual anode currents for any pot and transfer the data through Wi-Fi at the Control room of Plotline. Master unit captures the current data through radio frequency from all 16-slave units installed at individual anodes. After receiving the data from slave unit, master unit transmits the data to Control room through Wi-Fi Network. Instrument has high measurement accuracy.

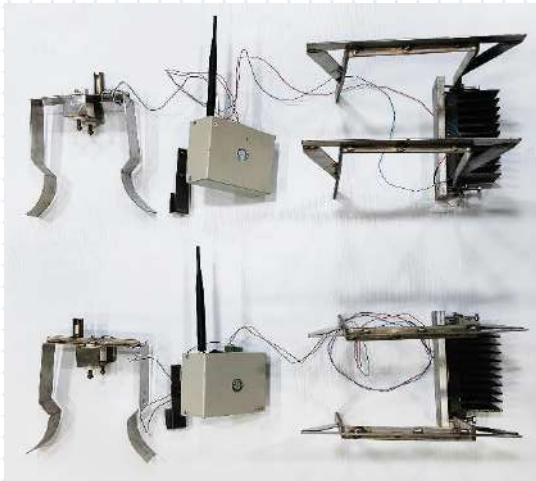
The system poses unique challenges. No power is available near the anodes hence a method of harvesting energy is



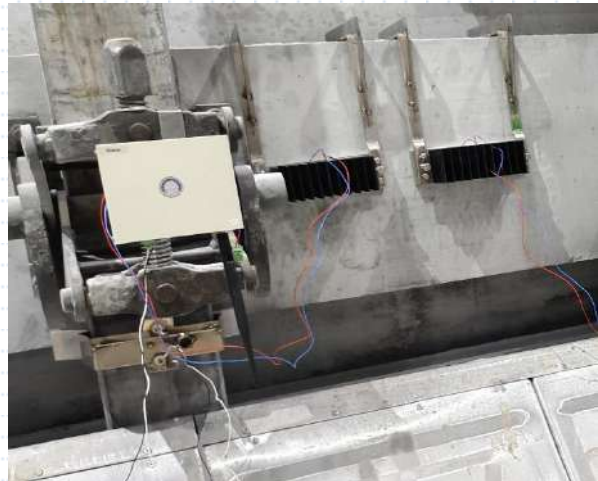
needed. As the anode current is DC, one cannot use inductive methods. Ambient light is low and ambient temperatures near the anode clamp can reach 70 degrees. This excludes the use of photovoltaic cells. There is no vibration hence no piezoelectric modules. Only option that remains is the use of thermoelectric energy harvesting. The electronics used in such applications also needs to a very low power design.

These challenges lead to the development of Wi-Fi enabled real-time anode current distribution measurement system using a special rechargeable NiMH battery capable of operation up to 75 degrees Celsius.

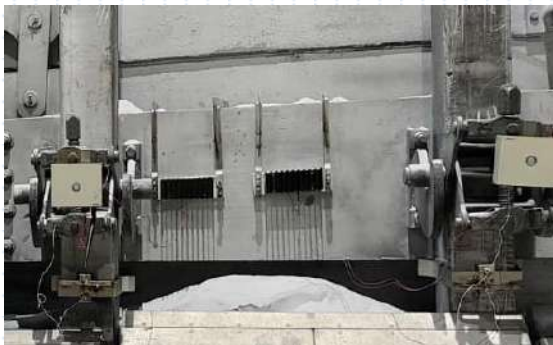
Software developed for the system provides graphical & tabular representations of current distribution data, with features for historical data storage and analysis. The ability to store and analyse historical data helps operators identify trends, optimize processes and predict future issues, improving long-term plant performance.



**Hanging Type Clamps sets with Wi-Fi devices**



**Hanging Type Clamps sets with Wi-Fi devices installed at smelter plant**



**Slave unit and TEG unit arrangement**



**Tab for ACD measurement**



**Installation of 16 Wi-Fi enabled data acquisition system and TEG Module**

**Outcome:**

- Developed a system which automates the measurement of anode current distribution, eliminating the need for manual measurements using probes. This automation leads to significant labour savings, improved precision and the ability to perform real-time monitoring.
- As it allows continuous, real-time monitoring of current flow in individual anode stems, operators can observe current variations in real-time & make adjustments as needed, enhancing process control and stability in aluminium production.
- Data is wirelessly transmitted from slave units to the master unit and subsequently to the control room via Wi-Fi. It minimizes wiring complexity and enables remote monitoring, reducing manual efforts and enhancing operational efficiency.
- The use of TEG for energy harvesting allows continuous recharging of the Ni-MH batteries in the slave units, eliminating the need for manual charging. This results in continuous system operation without downtime for battery replacement or charging, reducing maintenance efforts and improving system uptime. TEG modules harvests energy from the temperature difference between the aluminium pot & the surrounding environment. This technique making the system more energy-efficient and cost-effective. The system provides high-precision data and allows for accurate monitoring of voltage drop and temperature across anodes.
- No electromagnetic interference issues during continuous operation in the aluminium smelter plant. This ensures the system's reliability and consistency in transmitting accurate data even in challenging industrial environments. Improves the overall efficiency of the smelting process.
- System was tested and validated in NALCO's aluminium smelter, demonstrating its accuracy & reliability in measuring anode current distribution. The validation of the system ensures that it meets industry standards for accuracy & reliability for its use in smelter.

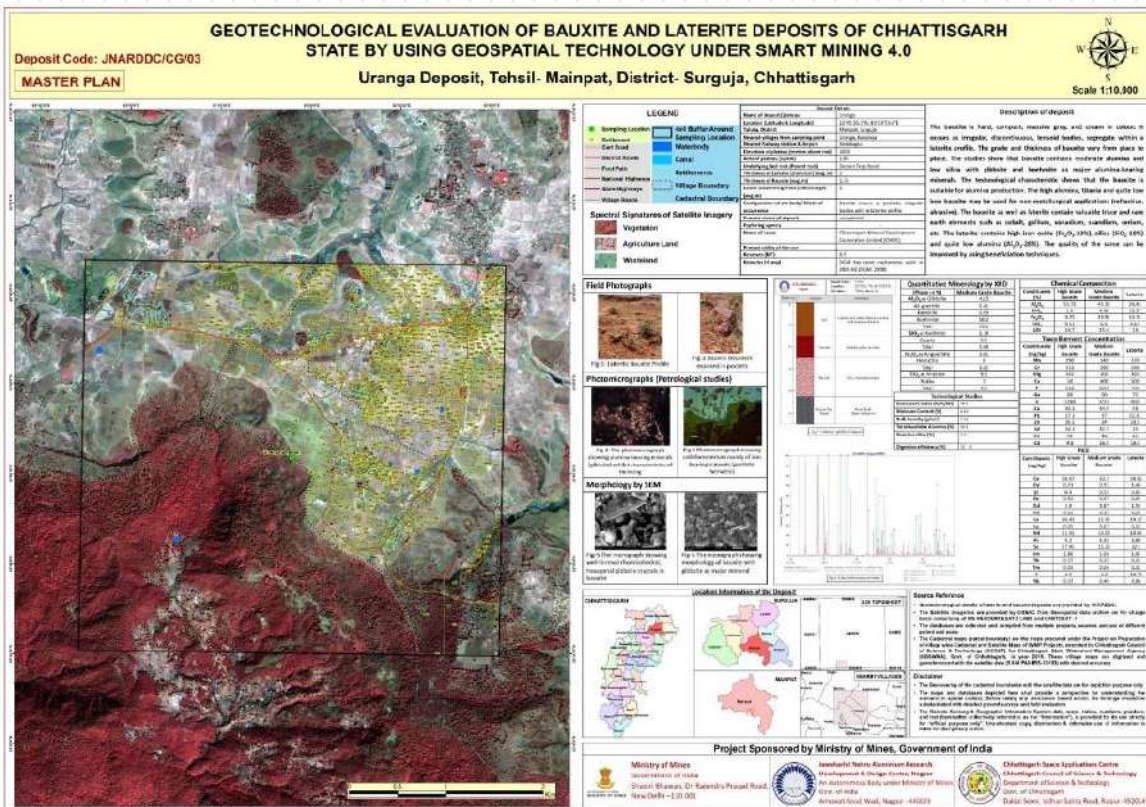
**S-35: Geo-technological evaluation of Bauxite and Laterite deposits of Chhattisgarh State by using Geospatial technology under Smart Mining 4.0 (With Chhattisgarh Council of Science & Technology, Government of Chhattisgarh, S&T (Mines))**

**Objectives:**

- Creation of district-wise digital database of laterite and bauxite deposits for Chhattisgarh State using geo-referenced cadastral maps and high-resolution satellite imageries
- Geotechnological evaluation of bauxite and laterite deposits of Chhattisgarh State under smart mining 4.0 program.

**Background:**

While reviewing the lateritic bauxite deposits, JNARDDC conceived an idea of geotechnological evaluation and creation of digital database of lateritic bauxite deposits of Chhattisgarh State by using geospatial technology. The increasing demand for raw minerals and their management has created a need to develop a digital database along with the technological information of individual deposits useful for aluminium industries. The attribute information collected for geotechnological information of the laterite and bauxite deposits when integrated with the GIS database, in the spatial domain provides a new perspective, vital for the bauxite alumina industry and prospective miners.



**Outcome:**

- Geo-technological database generated (geology, chemical, mineralogy, REE, petrology, morphology, Bond work index, bulk density, moisture content, available alumina, reactive silica, digestion efficiency). Geoinformatics database such as cadastral boundaries, geomorphology, pre-field investigation perception, identification of prospective deposits/ area, demarcation of rock/ ore bodies, etc. is useful for various entrepreneurs who are participating in mining auction process. The database provides a deep insight about the various deposits which will be used by the entrepreneurs for metallurgical and non-metallurgical applications and State Mining department for auction.
- Generation of exhaustive and comprehensive digital database of laterite and bauxite deposits in geospatial domain. Multiple unique outputs like GeoPDF, KML, and GIS projects have been generated.
- Entrepreneurs can identify deposits suitable for metallurgical and non-metallurgical applications.
- The developed geotechnological database on bauxite deposits will be utilised by bauxite miners, alumina industry and State mining department in auction process.

**S-36: Solid-state recycling of aluminium chips (waste) for production of billets for pilot scale extrusion: S&T (Mines)**

**Objectives:**

Utilization of aluminium swarf/ chips of AA2024 for the production of aluminium billets for extrusion, its validation at pilot scale using extrusion press, testing and characterization to understand the feasibility of the process.

**Background:**

The consumption of aluminium is projected to increase by 4% per year over the coming decades, and the amount of aluminium waste generated has also risen dramatically. A significant portion of this waste comes from aluminium swarf - the debris and byproducts created when aluminium stock is machined or turned. Annual global swarf generation is estimated to be well over 2.3 to 5.8 million metric tons. To recycle this swarf the traditional industrial practice consists of cleaning, drying, compaction, melting, molten metal treatment, and ingot production. These remelting techniques consume large amounts of energy and emit CO<sub>2</sub> gases, as well as nearly 10-20% of metal loss in the form of dross. Even with all possible efforts, these melt losses could not be completely avoided during the recycling through the remelting process. However, emerging solid state recycling processes provide more sustainable methods to reclaim aluminium from swarf.

Solid state recycling or direct recycling utilizes mechanical processes, rather than remelting. Also, is anticipated to require much lesser energy than remelting, reducing the carbon footprint of recycling substantially. As pressure builds to increase recycling rates and improve sustainability and prevention of natural resources in aluminium products, the adoption of solid-state recycling of swarf is expected to grow.

Worldwide various institutions and R&D centres attempted solid-state recycling process at the laboratory scale. Hence there is a need for upscaling so that bulk aluminium swarf utilization is possible, for the sustainable development of the aluminium recycling industry. For the aforementioned reasons, JNARDDC undertook this project for developing the solid-state recycling process for aluminium chips by manufacturing billets which is subsequently extruded in the in-house extrusion press. As this project is industrially and socio-economically relevant, it is expected that this project would be beneficial for various aluminium recyclers and extruders in the country.



Machined AA2024 chips

Compacted billet

Extruded rod from solid-state recycled billet

**Outcome:**

Developed a novel pilot-scale solid-state process, which is environmental friendly and low melt loss process, for the recycling of AA2024 aluminium swarf/chips to replace conventional re-melting. The following are the highlights of the findings achieved in this project:

- Among the cleaning solvents, like DM water, ethanol and acetone that were tried to remove dirt, coolant, and oil residues adhered to the AA2024 swarf, acetone is found to be the best cleaning solvent for the same time duration.
- The pilot-scale compacted billets produced using 1400 Ton extrusion press attained an average density of more than 85% and these compacts were successfully extruded with an extrusion ratio of 62 into 19 mm round bars using the same extrusion press.

- The peak load observed in solid state recycled billet extrusion was 26% lesser than that of commercial billet extrusion.
- The strength of solid-state recycled billet extrudate is 8% higher than that of commercial billet extrudate.
- The cost-benefit and equivalent CO<sub>2</sub> emission analysis disclosed approximately 35% and 92% savings when the billet is produced via solid-state recycling as compared to commercial AA2024 billets.
- The C-Channel profile extrudate produced from semi-solid cast homogenized billet (with swarf to base metal scrap ratio of 1:1) is found to have mechanical properties similar to that of commercial billet extrudate.
- The peak load of extrusion did not change with the production of billet by semi-solid casting.
- The knowhow will be shared with the relevant manufacturing companies for exploring the utility of this process.

### S-43, 44 & 45 : Techno-Economic Survey of Copper / Lead / Zinc Scrap Recycling in India; S&T (Mines)

#### Objectives:

- To establish a techno-economic scenario of copper, lead, and zinc scrap recycling industries in India.
- To support and promote sustainable recycling practices and circular economy for these metals.
- To provide insights for policy formulation by the Ministry of Mines, Government of India, aiding in the development of competitive and environmentally sound recycling practices.

#### Background:

Non-ferrous metals like copper, lead, and zinc are vital for various industrial applications, making their recycling crucial for resource conservation, energy savings, and reducing environmental impact. With increasing demand, a shift towards a circular economy that emphasizes true recycling is necessary. Each metal has unique properties that allow for efficient recycling, making them suitable for sustainable use:

- **Copper:** Known as a "permanent material," copper retains its properties through repeated recycling. In India, copper recycling is critical due to the limited availability of high-quality ore and mining capacity. The industry, largely unorganized, relies heavily on scrap imports. The current recycling rate in India is about 18%, compared to a global average of 32%. Challenges include inefficient scrap collection and a lack of proper smelting and refining processes.



Field visits to copper recycling industries

- Lead:** As one of the most recyclable metals, lead recycling requires only 35-40% of the energy needed for primary production. Predominantly derived from end-of-life lead-acid batteries, the Indian lead recycling industry is regulated by environmental norms but remains constrained by technology penetration, especially in smaller units. The recycling sector is dependent on imports for a significant portion of its raw material, adhering to guidelines under the Batteries Management Rules 2022.



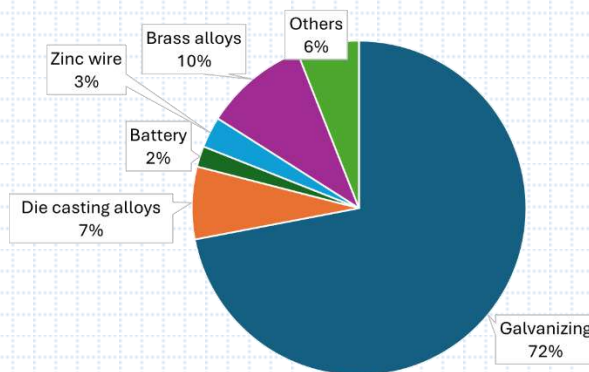
**Stake Holders meetings**



**Field visits**

Interactions with lead recycling industries

- Zinc:** Essential for corrosion prevention through galvanizing, zinc recycling in India is less developed, with a recycling rate of around 10% compared to a global average of 35%. Zinc residues, including ash and dross from the galvanizing process, are key sources for recycling. Despite the growing demand, the recycling industry is largely unorganized, with many processes like the Waelz method still underutilized.



**Zinc end-uses in India**

## Zinc production and consumption statistics

	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Primary zinc production (tons)	791461	696283	688286	715445	775808	820898
Secondary zinc production (tons)	81173	93834	75507	49423	79049	91402
Total production (tons)	872634	790117	763793	764868	854857	912300
Total consumption (tons)	650755	622188	596575	519008	717186	743647
Share of secondary zinc (%)	12.47%	15.08%	10.41%	6.46%	9.25%	10.02%
Per-Capita Consumption	0.48	0.46	0.43	0.38	0.51	0.52

The surveys, conducted by JNARDDC (Jawaharlal Nehru Aluminium Research Development and Design Centre), aimed to provide a holistic overview of the recycling industries, identify infrastructural needs, and support policy development for the Ministry of Mines.



Figure 4 Field visits to zinc recycling industries

### Common Outcomes:

The combined insights from the surveys on copper, lead, and zinc recycling highlight several key outcomes:

#### 1. Industry Overview and Growth:

**Copper:** The Indian copper industry, valued at \$8 billion, supports 50,000 jobs and is expected to see a significant increase in consumption by 2030, driven by sectors like electric vehicles and infrastructure.

**Lead:** The recycling activity is widespread, with numerous recyclers across the nation handling lead-acid batteries as the primary scrap source.

**Zinc:** Despite the low domestic recycling rate, the industry shows potential for growth, especially with increased focus on recovering zinc from galvanizing residues.

## 2. Dependency on Imports:

All three metal recycling industries rely significantly on imported scrap, adhering to ISRI specifications. For copper and lead, domestic recycling is complemented by imports, though capped by regulations. Zinc recycling also depends on imported materials due to limited availability of domestic scrap.

## 3. Technology Adoption and Challenges:

Large and medium-sized units have adopted advanced sorting and beneficiation technologies such as eddy current separators, magnetic separators, and briquetting machines to improve scrap quality. However, smaller units lag in technology penetration, leading to inefficiencies and environmental concerns.

Direct melting is common in the copper recycling sector, but the lack of proper smelting and refining processes results in quality issues. For zinc, the recovery of zinc from steel industry dust remains a challenge, with a need for wider adoption of processes like the Waelz process.

## 4. Environmental Concerns:

The surveys underline the environmental challenges posed by improper handling of non-metal components in scrap, particularly in lead and zinc recycling. Eco-friendly practices are limited to a few large players, while smaller units often lack the necessary infrastructure for safe disposal.

## 5. Government Initiatives and Policy Support:

The Ministry of Mines is actively working on initiatives like the National Non-Ferrous Metal Scrap Recycling Policy and Circular Economy frameworks. JNARDDC has contributed significantly by providing various standards and recommendations, including:

- **Process Standards for Recycling/Remelting:** Guidelines for scientifically improved recycling practices for copper, lead, and zinc, focusing on energy-efficient and environmentally friendly methods.
- **Minimum Infrastructure Requirements:** Specifications for the necessary infrastructure that recycling facilities must have, ensuring safety, efficiency, and environmental compliance.
- **Minimum Recycled Content Requirements:** Defined thresholds for the percentage of recycled content in products made from copper, lead, and zinc to promote the use of secondary materials.
- **Rating of Recycling Industries:** A mechanism for rating recycling units based on their adherence to best practices, technological adoption, and environmental performance.

- **Green Rating of Products:** A system for rating products made from recycled materials, helping consumers make environmentally conscious choices.
6. JNARDDC is also developing a dynamic web portal to monitor the recycling industry, facilitating real-time data collection and enabling a ranking mechanism to transform the sector into a more organized and structured system.
7. **Future Opportunities and Policy Contributions:**

The outcomes of the survey have already contributed to the preparation of key policy documents for the Ministry of Mines, including:

- **Guidelines for Processing of End-of-Life (EoL) Copper / Lead / Zinc Scrap.**
- **Zero Waste Management Policy:** For sustainable waste utilization in the zinc secondary, downstream, galvanizing, and chemical industries.
- **Extended Producer Responsibility (EPR) Provisions:** For the effective utilization of non-ferrous scraps and wastes.
- **Standard Operating Procedures (SOPs) for Air Pollution Norms:** Specific to zinc recovery from Electric Arc Furnace (EAF) or Induction Furnace (IF) dust in the steel industry.

### **Conclusion:**

The combined findings from the techno-economic surveys of copper, lead, and zinc recycling underscore the need for modernization, regulatory support, and infrastructure development to unlock the full potential of these industries. By embracing advanced technologies, adopting best practices, and implementing the recommended standards and policies, India can not only meet its growing demand for these critical metals but also contribute to global sustainability goals through efficient resource management. The findings will play a pivotal role in the formulation of policies pertaining to the non-ferrous recycling industry, aligning with the ministry's vision for sustainable and competitive growth.

**N-49: Demonstration cum heat treatment, leaching-recycling and liming study of JNARDDC-NALCO process ( by utilizing 50-60 kg batch of 1st cut SPL); NALCO Bhubaneswar**

**Objectives:**

JNARDDC had developed a simple and cost-effective process on bench scale (1 Kg Capacity) for detoxification of 1st cut SPL. Based on these successful results, it was decided to undertake the batch scale study for 50-60 kg as a scale up initiative.

**Background :**

Worldwide aluminium is produced by electrolysis of alumina at high temperature (~960 °C) in molten Cryolite/AlF<sub>3</sub> bath. The electrolysis pot is provided with electrically conductive carbon linings acting as a cathode in the pot. During the electrolysis process, direct current is conducted into the melt through prebaked carbon anode to electrolyze the dissolved alumina.

Over a period of electrolysis pot operations, the carbon lining gradually deteriorates due to penetration of elemental sodium and liquid bath materials into the pores of carbon lining material. This results into the cracks or heaving/swelling of cathode which results into the reduction in the integrity of linings. The pot is said to be failing when iron is detected in molten aluminium, when cell voltage increases or when pot leaks molten metal or electrolytes. Upon failure of pot, the pot is emptied and cooled down. The pot is then removed from pot room to working area to dismantle the linings. By mechanical drilling the steel shell is stripped of carbon lining and refractory lining for re-lining with new materials. Stripped linings separated into two fractions named as 1st cut SPL (carbon portion) and 2nd cut SPL (refractory portion). The 1st cut SPL is declared hazardous waste by CPCB (India) due to presence of inorganic toxic cyanide. The high toxicity of cyanide is well defined 70 mg KCN has a 50% chance to kill a person of 70 kg within 15 minutes (Lygre, 1994). Therefore, the SPL is generally stored with high precautions in rail cars, dumpsters, or piles prior to treatment and disposal. It is estimated that on world average 3-5% of SPL is generated during production of aluminium by electrolysis process.

Elements/oxide elements	of	1st cut SPL
Carbon		40-70 %
Al <sub>2</sub> O <sub>3</sub>		8-20 %
SiO <sub>2</sub>		0.5-8 %
CaO		01-2 %
Fe <sub>2</sub> O <sub>3</sub>		0.3-1 %
Total Na <sup>+</sup>		10-20 %
Total F-		5-12 %
Leachable		2-5 %
Non-leachable		3-7 %
Total Cyanide		500-3000 ppm
Leachable		100-2000 ppm
Non-leachable		400-1000 ppm

According to CPCB if any solid waste contains leachable cyanide more than 20 ppm and/or 180 ppm fluoride (TCLP), then it is classified as hazardous waste under class A. Hence JNARDDC undertook this project to scale up the bench scale project from 1kg level to batch level of 50-60 kg.



#### Outcome :

The results/observations of batch scale studies were found interesting. More than 98% of leachable cyanide gets destructed during heat treatment. The concentration of caustic product [Na<sub>2</sub>O(t)] reached up to 61.4 gpl by repeated recycling. The Carbon product obtained is free from leachable cyanide, fluoride, and sodium and can be used in (i) a captive power plant as fuel (by mixing a certain proportion with present raw material/coal), (ii) In anode manufacturing (carbon is mostly in form of graphite and may increase electrical conductivity), (iii) Ramming paste preparation or (iv) Cement industry (as fuel and mineralizer). The calcium fluoride product obtained is 65% pure with the rest being lime can be used as a flux in the steel industry

## Ongoing Projects 2023-24 : 18 nos.

SN	Project Title with timeline	Outcomes / Remarks
1.	<p>S-37 / P-63: Technology Development for Holistic Utilization of Red Mud for Extraction of Metallic Value &amp; Residue Utilisation</p> <p><b>[S&amp;T(Mines) NML, Jamshedpur, IMMT, Bhubaneswar, NALCO, HINDALCO &amp; VEDANTA] under the aegis of NITI Aayog</b></p> <p>Mar 2022 (3 yrs)</p>	<p>Under the NITI Aayog initiative, the primary industries and 3 R&amp;D labs have joined hands to develop feasible processing options for all metal extraction and REE enrichment from red mud and further research, development and commercialisation to other industries. The outcome will lead to the development of a Master Flowsheet for selected grades of red mud with energy and material balance equipped with techno-economic feasibility.</p>
2.	<p>S-38: Red mud valorisation to achieve zero waste, conversion of residue into diagnostic x-ray shielding tiles after recovery of scandium. <b>S&amp;T(Mines) (CSIR-AMPRI, Bhopal):</b></p> <p>Mar 2022 (2½ yrs)</p>	<p>The main objective of this project is to convert red mud into economically useful, high-energy X-ray and gamma-ray shielding blocks suitable for building radiation therapy bunkers, nuclear power plants, food sterilisation plants, etc. thereby promote the zero-waste concept.</p>
3.	<p>S-39: Development of medium strength Al-Mg-Si (AA6082 based) alloy for high-end strategic applications (extruded or drawn tubes).</p> <p><b>S&amp;T(Mines) &amp; (IIT Gandhinagar)</b></p> <p>May 2022 (3 yrs)</p>	<p>The aluminium tube industry is currently battling with low strength of the finished product using AA6082 alloy. This project aims to develop a medium-strength Al-Mg-Si (AA6082) based alloy with optimized composition and heat treatment schedule and achieve higher mechanical properties. Developing and indigenization of material for national space, aerospace and defence applications.</p>
4.	<p>S-40: Un-diluted Recycling of Cast Aluminium Alloys Containing High Fe Impurity Suitable for SMEs:</p> <p><b>S&amp;T (Mines) (BML MUNJAL University, Gurgaon and</b></p>	<p>New alloys were developed at lab scale with higher Fe content upto 2.5% which has better properties (especially wear and high temperature creep) than conventional</p>

	<p><b>Ramakrishna Engineering College, Coimbatore)</b> May 2022 (2 yrs)</p>	<p>base alloys. Based on encouraging results, the scale-up project will be taken up for two-wheeler automobile pistons with new alloys in collaboration with the industry partner, Motocast Power Alloys Private Limited, Rajasthan. Furthermore, industrial scale implementation for Fe reduction is being carried out at TENNECO, Bangalore, a global automotive component manufacturer.</p>
5.	<p>S-41: Production of Onyx grade ATH (sodium bicarbonate route) using low-grade Bauxite from Kutch region of Gujarat. <b>S&amp;T(Mines) (Kalinga Institute of Industrial Technology, KIIT, Bhubaneshwar and industry partner - NIKNAM Chemicals Pvt. Ltd)</b> July 2022 (2 yrs)</p>	<p>The Kutch bauxite deposits of Gujarat are low-grade ore due to low alumina and high iron and silica content. Hence it remains unutilised as it cannot be used for alumina production. The project aimed to produce Onyx grade ATH with whiteness greater than 96% using sodium bicarbonate route for its use in synthetic marble/onyx application. However, the whiteness of the product developed is only up to 90% through this sodium bicarbonate route. Hence, the proposed method is not technically viable for its application in synthetic marble and cannot be scaled up.</p>
6.	<p>S-42: Fabrication of Al<sub>2</sub>O<sub>3</sub> containing cellulose-based Ag NPs encapsulated collagen dressing and investigation of its therapeutic opportunities in diabetic wound healing <b>S&amp;T(Mines) (Kalinga Institute of Industrial Technology, Bhubaneshwar)</b> Dec 2022 (2 yrs)</p>	<p>Chronic wounds are conventionally addressed using various FDA-approved silver-based formulations and other biomaterials. To overcome this issue an alternative material viz alumina (Al<sub>2</sub>O<sub>3</sub>) is being tried in wound management devices. R&amp;D on Al<sub>2</sub>O<sub>3</sub> will be done at JNARDDC and KIIT will use its facility at the School of Biotechnology for tests and validation related to animal toxicity and will source biological samples from its hospital (KIMS) for the developed healing material.</p>

7.	<p>S-46: Development of low-cost filler material utilizing Lithomargic clay for the paint industry as per IS 68 2006 standard: (Industry partner: <b>S&amp;T(Mines) Mundle Paint and Chemicals, Bhandara</b>) Mar 2023 (2 yrs)</p>	<p>The bauxite deposits of Central India are associated with lithomarge clay resources. However, these resources are not used by mine owners as well as the aluminium industry. The project aims to utilize Lithomarge clay for the development of low-cost filler material for the paint industry as per IS:68 (2006) standard. The samples have been prepared and trials are in progress at paint industry.</p>
8.	<p>S-47: Development of prototype aluminium seat frame for passenger buses. <b>S&amp;T(Mines)</b> (Joint project with <b>Automotive Research Association of India, ARAI, Pune</b>) Jan 2023 (2 yrs)</p>	<p>The existing seat structure is made of steel material for a 2x2 passenger bus seat frame which weighs about 15-18 Kg per seat. The project aims to design and develop lightweight aluminium seat frames for passenger bus applications. Replacing it with medium-strength alloys such as AA6061, and AA6082 will bring a saving of 5-6 Kgs/seat. With the collaboration of ARAI, Pune it is proposed to simulate the die design, die fabrication and extrude the profiles and validate the prototype of aluminium seat frame for passenger vehicles as per AIS 023 standard.</p>
9.	<p>S-48 : Process for production of ATH with high whiteness using non-metallurgical grade bauxite by following soda sintering process : <b>S&amp;T(Mines) (With Institute of Chemical Technology (ICT) Mumbai Indian Oil Campus Bhubaneswar and Industry Partner : NIKNAM Chemicals PVT. Ltd)</b> Jan 2024 (2 yrs)</p>	<p>Project aims for production of ATH with high whiteness using non-metallurgical grade bauxite by following soda sintering process leading to value addition</p>

10.	S-49 : An optimal approach for the retrieval of value-added substances from secondary aluminum black dross : <b>S&amp;T(Mines)</b> <b>Sri Ramakrishna Engineering College, Coimbatore</b> <b>Industry Partner : Phoenix Alloys</b> Jan 2024 (2 yrs)	Project aims for retrieval of value-added substances from secondary aluminum black dross.
11.	N-47: Development of Process for 4N High Pure Alumina (HPA) and Substrate Making for its Validation in LED applications; <b>NALCO, Bhubaneswar Odisha: (IIT, Bhubaneswar &amp; Anna University)</b> Apr 2021 (3 yrs)	The project successfully developed a scalable process for producing 4N high-purity alumina (HPA) and substrate at lab scale. Draft project report under preparation. Semi-pilot scale up will be proposed to NALCO with their support.
12.	N-48: Development of DC cast Al Alloy for Yoke in automobile applications, <b>NALCO Bhubaneswar (with ARAI Pune)</b> May 2022 (2½ Years)	An automotive yoke is usually made of steel or cast iron. Aluminium alloys are widely used in automotive applications due to their excellent strength-to-weight ratio, significantly reducing fuel consumption and enabling them to meet emission norms. The project aims to develop a new DC cast Al Alloy followed by the development of the prototype yoke used in automobile applications.
13.	N-50: Kinetic study of different unit operations like digestion and desilication. <b>NALCO, Bhubaneswar</b> Jul 2023 : (1 ½ yr)	The objective of this work is to study the digestion kinetics of process bauxite of NALCO and a mixture of process and desilicated bauxite at various parameters. Desilication kinetics will also be studied. Finally, the results will be evaluated using a suitable software at NALCO
14.	N-51: Detailed Thermal / Heat Balance study of the cast house furnaces to increase furnace efficiency, <b>NALCO</b> June 2023 (1 ½ yr)	The objective of the project is to carry out a comparative study by detailed thermal balance analysis of two numbers of cast house furnaces (highly efficient and low efficient) and explore the possibilities for improvement in energy efficiency.

15.	P65:EE:53 Recycling coal mine to reuse as a value-added building material to promote a circular economy, <b>Ministry of Coal (CPMDIL, BIT Mesra &amp; VNIT):</b> Sept 2023 (2 yrs)	The project will lead to development of mix designs from coal mine overburden (COM) in homogenized slurry form for making building elements (panels, bricks and concrete) by heat treatment and geopolymer processes for their prospective use in urban and rural housing.
16.	P-66 : Utilization of aluminium dross in synthetic slag preparation for secondary steel making” <b>Daiki Aluminium Industry India Pvt. Ltd, Sricity, AP</b> Dec 2023 (2 yrs)	The project aims to utilize aluminium dross in synthetic slag preparation for secondary steel making leading to effective utilization of industrial waste.
17.	P67: Coal mine overburden alkali-activated composites (CMOAAC) for pre-fabricated 3D volumetric construction elements & system thereof (3DVCES) <b>(Ministry of Coal, CPMDIL, IIT-BHU &amp; VNIT):</b> Dec 2023 (2 yrs)	The objective is to review, design and develop the coal mine overburden alkali activated construction products (CMOAAC) for pre-fabricated 3D elements of viscoelastic materials by using alkali based additives which has prospective use in mass housing applications.
18.	P-68 : Evaluation of CGM (Crystal growth modifier) <b>Kimberlite Chemicals Pvt Ltd. Bangalore</b> Mar 2024 (3 mts)	Project will undertake research work for performance evaluation and dosages optimization of CGM

## Collaborative Work



JNARDDC is collaborating with the following agencies for various R&D projects and assignments.

1. **NITI AAYOG:** The development of effective handling, storage, usage, and management of red mud is a major concern for the global community as a whole. In order to make India self-reliant in Rare Earth Extractions ("REEs"), NITI Aayog has identified many secondary resources for rare earth extraction among which Red Mud is the only known resource of scandium, a REE, which is more enriched as compared to native bauxite. Under the aegis of NITI Aayog multiple institutions including JNARDDC are involved in the development of feasible processing options for all metal extraction from Red Mud which is likely to be completed in the next year.
2. **Kalinga Institute of Industrial Technology, KIIT, Bhubaneswar:** JNARDDC is executing two R&D joint projects with KIIT (i) Production of Onyx grade ATH (sodium bicarbonate route) using low-grade bauxite from Kutch region of Gujarat & (ii) Fabrication of Al<sub>2</sub>O<sub>3</sub> containing cellulose based Ag NPs encapsulated collagen dressing and investigation of its therapeutic opportunities in diabetic wound healing.
3. **BML MUNJAL University Gurgaon** has collaborated with JNARDDC in executing the project S&T (Mines) Un-diluted Recycling of Cast Aluminium Alloys Containing High Fe Impurity Suitable for SMEs
4. **Department of Science and Technology (DST):** JNARDDC has completed the project - "Instrument for Realtime measurement of anode current distribution of aluminium electrolysis cell" under R&D program of DST.
5. **Chhattisgarh Council of Science & Technology :(CCOST), Raipur** an autonomous body of the Government of Chhattisgarh joined hands with JNARDDC for completing the project - Geo-technological evaluation of Bauxite and Laterite deposits of Chhattisgarh State by using the Geospatial technology under Smart Mining 4.0. The joint venture activity for Bauxite Mining 4.0 will open up new vistas for the utilization of advanced RS, GIS, and GPS technology in the area of laterite and bauxite ore utilization by the aluminium industries.

6. **CSIR - Advanced Materials and Processes Research Institute AMPRI, Bhopal:** JNARDDC and AMPRI, Bhopal are executing a joint project which aims to convert red mud into economically valuable very high-energy X-ray and gamma-ray shielding blocks, which are suitable for building radiation therapy bunkers, nuclear power plants, food sterilization plants, etc., and thereby to promote the zero-waste utilization of red mud.
7. **MRAI (Material Recycling Association of India), NALCO, NMDC & MSTC:** JNARDDC along with the above organisation has conducted 75 major circular economy campaign events all over the nation on the occasion of Azadi Ka Amrit Mahotsav to commemorate the 75th year of India's independence –The program focused on sustainability in Ferrous and Non-Ferrous Metals (Aluminium, Copper, Lead, and Zinc). It included programs in 22 ZP schools of 11 districts of Vidarbha.
8. **CSIR - Institute of Minerals and Materials Technology, IIMT Bhubaneswar:** A multi-institutional project “Technology Development for Holistic Utilization of Red Mud for Extraction of Metallic Value & Residue Utilization” is under process”.
9. **Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India** JNARDDC is the aluminium sector expert under PAT-2 / PAT-3 (Perform, Achieve & Trade) Scheme in the National Mission for Enhanced Energy Efficiency (NMEEE) under Climate Change of Bureau of Energy Efficiency (BEE), Ministry of Power. The Centre has successfully carried out a technical evaluation under PAT schemes to support the BEE in reducing the energy consumption of the aluminium sector. The recommendation will help BEE in the generation and trade of e-certificates under the PAT scheme. It will also be useful in setting up energy reduction targets for the PAT-3 scheme. The scheme details are available at <https://beeindia.gov.in/sites/default/files/Aluminium.pdf>. In addition to the above, JNARDDC is working in the field of Waste utilization of SPL & Dross with BEE.
10. **Bureau of Indian Standards (BIS):** JNARDDC provided its invaluable inputs to BIS for formulating standards for aluminium scrap and other aluminium alloys.
11. **IIT, Bhubaneswar & Anna University:** NALCO, Bhubaneswar sponsored project “Development of Process for 4N High Pure Alumina (HPA) and Substrate Making for its Validation in LED applications” is in its final year of execution in collaboration with IIT-Bhubaneswar and Anna University. India does not have a production base of LED due to the import of 3N and 4N alumina. Because of the market, product potential, and availability of raw materials in India, the project outcome has a commercial potential to add to the vision of the Make in India program suitable for LED (Light Emitting Diode) and Semiconductor applications.

12. **CSIR - National Metallurgical Laboratory NML, Jamshedpur:** Under the aegis of NITI Aayog multiple institutions including NML, Jamshedpur are involved in the development of feasible processing options for all metal extraction from Red Mud “Technology Development for Holistic Utilization of Red Mud for Extraction of Metallic Value & Residue Utilization”
13. **The Automotive Research Association of India (ARAI), Pune** is the leading automotive R&D organization in the country affiliated with the Ministry of Heavy Industries, Government of India. ARAI is the prime Testing and Certification Agency notified by the Government of India under Rule 126 of Central Motor Vehicle Rules, 1989. JNARDDC and ARAI have taken a joint project of S&T(Mines) for Development of a prototype aluminium seat frame for passenger buses and of NALCO for the development of a new DC cast Al Alloy followed by the development of the prototype yoke used in automobile applications.
14. **Private Industries & Academia :** *Phoenix Alloys Silvassa : NIKNAM Chemicals* PVT. Ltd, Nagpur : Sri Ramakrishna Engineering College, *SREC Coimbatore : Daiki Aluminium* Industry India Pvt. Ltd, *Sricity, AP: Kimberlite Chemicals Pvt Ltd. Bangalore* : Institute of Chemical Technology (*ICT*) *Mumbai* Indian Oil Campus Bhubaneswar : All these private industries and academic institutes are providing industry support and collaboration in various R&D projects.
15. **Ministry of Coal with BIT Mesra, CPMDIL, IIT-BHU & VNIT:** Two projects are being executed in collaboration with above institutes - Recycling coal mine to reuse as a value-added building material to promote a circular economy & Coal mine overburden alkali-activated composites (CMO AAC) for pre-fabricated 3D volumetric construction elements & system thereof (3DVCES).
16. **Directorate of Geology & Mining department, Chhattisgarh.** JNARDDC and DGM is working on the issue of mapping of overburden to identify critical minerals including assessment of rare earth elements (REE) within lateritic bauxite profiles across both existing and untapped deposits.

17. **Ministry of Mines: JNARDDC** is the designated aluminium sector expert / nodal agency for the following key authorities and is undertaking the following activities.
- Metal Recycling Authority (MRA) - to carry out the functions earmarked for MRA as stipulated in the “National Non-Ferrous Metal Scrap Recycling Framework 2020.”
  - EPR policy guideline (Ministries (MOEFCC and MoM). Carry out scoping and have stakeholder consultation for EPR provisions for different wastes and scraps for effective utilization).
  - Implementing agency for promoting startups and MSMEs through the S&T-PRISM program.
  - Vision document on recycling for non-ferrous sector - Detailed report on Recycling sector to identify the current status and future prospects.
  - Setting up of Centralized Dross treatment facility (Aluminium).
  - Laying down process standards for scrap recycling Products
  - Laying down Minimum Infrastructure Requirement for recycling units
  - Develop performance indicators and a mechanism for ranking and evaluation of units in coordination with MoEF&CC and other stakeholders
  - Developing a mechanism (website) by JNARDDC for registration of segregators, dismantlers, recyclers, collection centres and all involved stakeholders.
  - Preparation of vision document on Circular economy in non-ferrous metal sector

18. **MOUs were signed with following agencies for various collaborative work.**

**MOU with VNIT:- 5<sup>th</sup> March 2024 :**

JNARDDC and Visvesvaraya National Institute of Technology, VNIT Nagpur enter into Memorandum of Understanding for technical cooperation in the field of scientific research and development. This MOU will pave the way for active interaction of students, faculties and researcher to promote scientific and technological advancements in the field of mineral and metal sector including recycling, circular economy, critical minerals etc. The agreement was signed by Dr. Anupam Agnihotri, Director, JNARDDC, and Dr. Pramo M. Padole, Director VNIT in presence of the HoDs of both institutions.



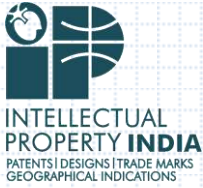
**MOU with OMC, Bhubaneshwar :- 13<sup>th</sup> Dec 2023 :**

OMC and JNARDDC cemented their partnership with the signing of a long-term Memorandum of Understanding for sample analysis services during the mega Business Partners Meet – 2023 organized by OMC at Bhubaneshwar.

**MOU with Caliche Guwahati :- 2<sup>nd</sup> Nov 2023 :**

Mr Anandh Mathew, COO of Caliche Guwahati, signed an MoU to embark on joint research ventures in the mining sector, extending beyond aluminum. Leveraging JNARDDC's technical expertise, the collaboration seeks to address key challenges and advance innovation in areas such as bauxite mining, selective recovery of rare earths, microbial extraction of elements, and recovery of minerals from mine waste.

# Patents - 4



The following patent applications were granted under the Patents Act, 1970 for various indigenous R&D process developed by JNARDDC under various research projects.



SN	Details of the granted patent
1.	A process for preparation of aluminium hydroxide with low soda content. Granted vide no. 455707 on 29.09.2023 <b>Dr Suchita Rai, M. T. Nimje, A Agnihotri</b>
2.	"Development of process for revitalization of high alumina castables from residual Aluminium dross. No. 471016 on 21.11.2023 <b>Dr Upendra Singh, M T Nimje, Shoeb Ansari, Anupam Agnihotri, (JNARDDC) &amp; A S P Mishra (VEDANTA)</b>
3.	A process for removal of iron oxide, silica and enrichment of alumina in ferruginous, siliceous and aluminous laterite by physical separation process No. 483133 on 15.12.2023 <b>Dr Pravin Bhukte, S P Puttewar, Anupam Agnihotri</b>
4.	A process for conversion of saprolite into refractory aggregate. No. 507474 on 06.02.2024. <b>Dr P G Bhukte, S P Puttewar, M T Nimje, M J Chaddha, M Najar, U Singh and A Agnihotri</b>



## Technical Papers Presented / Published & Conferences



### JOURNALS

1. Milling route for the synthesis of nano-aluminum hydroxide for the development of low-density polymer composites, Suchita Rai , Mukesh Chaddha , Manoj Nimje , Sneha Bahadure , Smita Mohanty and Anupam Agnihotri, International Journal of Materials Research, De Gruyter, 114 (7-8), pp.678-688, 2023 (SCIE journal, Impact factor: 0.678), <https://doi.org/10.1515/ijmr-2021-8663>
2. Process for Recovery and Value Addition of Silica Mineral Values of Distinctly Siliceous Mining Rejects; Mohamed Najar, Amrita Karn, Shweta Dhamande, Upendra Singh, Anupam Agnihotri; Materials Today Proceedings, 86, 2023, Science Direct, Elsevier Ltd., <https://doi.org/10.1016/j.matpr.2023.05.228>
3. Process for Recovering Silica from Lithomargic Clay: Value Addition of Unexploited Mining Reject; Mohamed Najar, Amrita Karn, Paresh Nageshwar, Pravin Bhukte, Mukesh Chaddha and Anupam Agnihotri, Chemical Technology and Metallurgy (JCTM), 59 (1) 2024, 129-136, Sofia, Bulgaria. [https://journal.uctm.edu/node/j2024-1/JCTM\\_2024\\_59\\_1\\_15\\_22-154\\_pp129-136.pdf](https://journal.uctm.edu/node/j2024-1/JCTM_2024_59_1_15_22-154_pp129-136.pdf)
4. Next generation gamma ray shielding blocks developed using alumina industry waste' in journal Construction and Building Materials, Rahul Arya , Rini Paulose , Varsha Agrawal , Ashutosh Pandey , Deepti Mishra , Sunil K umar Sanghi, Mohammed Akram Khan , Dehi Pada Mondal , M. Muhamed Shafeeq, Kaushik Banerjee, Sujoy Chatterjee , Supriya Mukhopadhyay , Pratap Roy , Ra man Ravishankar , Chandana Bhattacharya , Abhay Bhisikar , Paparao Mondal , Upendra Singh, Anupam Agnihotri , Avanish Kumar Srivastava ,Shabi Thankaraj Salammal) Volume 373, April 2023 <https://www.sciencedirect.com/science/article/abs/pii/S0950061823006074>
5. Use of red mud as advanced soil stabilization material, Suchita Rai, Sneha Bhadure, M. J. Chaddha, A. Agnihotri; Advanced Materials from Recycled waste, Book Chapter (Publisher: Elsevier), Chapter 3:2023 Pg: 45-56. <https://www.sciencedirect.com/science/article/abs/pii/B9780323856041000160?via%3Dihub>
6. Characterization and Beneficiation of Pyrophyllite” SPRINGER NATURE, Switzerland AG, Springer Book Series Springer Proceedings in Earth and Environmental Sciences P G.Bhukte, GT Daware, MJ Chaddha, TP Bhosale, A Agnihotri (Mar 2024); p 159-167 <https://www.springerprofessional.de/en/characterization-and-beneficiation-of-pyrophyllite/26848798>

7. Commercial and Technical Prospects of Unused Mineral Values of Aluminium Industry; Mohamed Najar, Pravin Bhukte, Upendra Singh, Manoj Nimje and Anupam Agnihotri, Current Trends in Mineral Based Products and Utilization of Wastes: Recent Studies from India - Prospects and Challenges of Mineral Based Products and Utilization of Wastes for the 'Make in India' Initiative, Nagpur, November 10-11, 2022, Springer Proceedings in Earth and Environmental Sciences , Springer Nature, Switzerland, AG, 2024.pp 240-253 <https://www.springerprofessional.de/en/commercial-and-technical-prospects-of-unused-mineral-values-of-a/26848812>
8. Potential Application of red mud in cement: An Indian Perspective, Suchita Rai, M. J. Chaddha,, Prachi Pradhan, K. J. Kulkarni, M. Panchal, A. Agnihotri , Springer Proceedings in Earth and Environmental Sciences (SPEES) , Springer Cham, 255- 264, Published online on 13th March 2024. [https://doi.org/10.1007/978-3-031-50262-0\\_20](https://doi.org/10.1007/978-3-031-50262-0_20)

## Conference Proceedings

### **27th International Conference on Non-ferrous Metals (ICNFM-2023), Ranchi July 7-8, 2023 Ranchi, India**

9. "Geotechnological evaluation of Lateritic Bauxite deposits by using Geospatial technology – A case study of Chhattisgarh deposits"; Tech 11; P G Bhukte, A Agnihotri, S Karmakar, G T Daware, T P Bhosale, Yudhaveer Singh
10. Organics in Bauxite and its impact on Alumina making process; Prachiprava Pradhan\*, Suchita B Rai, Megha Panchal, Kishore J Kulkarni, Upendra Singh, Anupam Agnihotri,
11. Development of recycling-friendly cast aluminium alloy to boost circular economy, R Anil Kumar, K Immanuel Raju, Dr A K Prasada Rao, R N Chouhan, Dr Anupam Agnihotri

### **Meet on "Geo-technological Evaluation of Bauxite deposits" organized by JNARDDC on August 18, 2023**

12. Lateritic bauxite deposits of Chhattisgarh and Maharashtra State" Meet on "Geotechnological Evaluation of Bauxite deposits" Pravin Bhukte, Gopal Daware, Tejas Bhosale, Bhargavi Kulkarni, Vinod Kshirsaut and Anupam Agnihotri.

### **Materials Today: Proceedings Publisher, Elsevier, 29th Sep 2023**

13. "Peripheral coarse grain formation in AA2024 and AA6063 aluminium alloys- a comparative study"; Immanuel Raju, V N S U Viswanath Ammu, R A Kumar, R N Chouhan, and A Agnihotri.
14. Effect of ram speed on surface quality and mechanical properties during extrusion of AA2024 alloy, VNSU V Ammu, Immanuel Raju, RN Chouhan, A Agnihotri; <https://doi.org/10.1016/j.matpr.2023.09.146>,
15. Effect of compaction pressure on cold compaction of AA2024 swarf generated during milling operation N.S. Anas, K.N. Ramteke, R.A. Kumar, R.N. Chouhan, A. Agnihotri, <https://doi.org/10.1016/j.matpr.2023.09.106>

16. Effect of Preheat Temperature on Compaction of Machined AA2024 Swarf; N.S. Anas, K.N. Ramteke, R.A. Kumar, K I Raju, VNSUV Ammu, R.N. Chouhan, A. Agnihotri, R Radhakrishnan, Transactions PMAI, 18, 2023, p 48-55

***International Conference on Metallurgical Engineering organized by IIT-BHU (Varanasi) during October 26-28, 2023.***

17. "Effect of pilot scale compaction of AA2024 swarf on densification, microstructure and mechanical properties," N S Anas, K N Ramteke, R A Kumar, K I Raju, VNSUV Ammu, R N Chouhan, A Agnihotri, R Radhakrishnan

***41st International Conference and Exhibition (ICSOBA -2023) November 05-08, 2023 at Dubai UAE;***

18. Production of Hydrogen using fine waste Aluminium dross: Secondary source of next generation Fuel; Upendra Singh, Jyoti Pendam, Sonali Thawrani, Paparao Mondri, M. Najjar & Anupam Agnihotri
19. "A process for development of calcined bauxite from ferruginous bauxite"; Pravin Bhukte, Gopal Daware, Tejas Bhosale and Anupam Agnihotri (2023)

***77th Annual Technical Meeting of the Indian Institute of Metals (IIM-ATM) and International Conference on Metals, November 22-24th at KIIT Bhubaneswar, 2023***

20. Assessment of nonferrous mining overburden materials to support sustainable and gainful use of unused resources : Case study of manganese overburden material , Mohamed Najjar, Paparao Mondri, Kiran Janbandhu, Shweta Dhamande, Upendra Singh and Anupam Agnihotri
21. Hydro-chemical Treatment of Low Grade /Medium Grade Manganese ore for Recovering Manganese: A green approach to Value Addition and Circular Economy, Paparao Mondri, Kiran Janbandhu, Mohamed Najjar, Upendra Singh and Anupam Agnihotri
22. "Effect of pilot scale extrusion of AA2024 swarf on densification, microstructure and mechanical properties; N S Anas, K N Ramteke, R A Kumar, K I Raju, VNSU V, Ammu, R N Chouhan, A Agnihotri, R Radhakrishnan
23. "Effect of lime addition during digestion of gibbsite bauxite in Bayer's process"; P Pradhan, S B Rai, K J Kulkarni, M Panchal, and A Agnihotri.
24. "A study on east coast bauxite: Can selective grinding as a beneficiation option favour rare earth enrichment in the bauxite ore/red mud? S Rai, P Pradhan, K J Kulkarni, M Panchal, U Singh, and A Agnihotri,

**11th International Bauxite, Alumina & Aluminium Conference & Exhibition (IBAAS-JNARDDC 2023), December 4-6, 2023, Chitnavis Centre, Nagpur, Maharashtra.**

25. "Preparation of 2-Propanol Aluminum Salt (AIP) as an Intermediate for 4N Pure Alumina without Employing a Catalyst," P Nayar, P Yadav, U Singh, and A Agnihotri,
26. "Development of Medium Strength Al-Mg-Si Alloy for Extruded and Drawn Tubes". K I Raju, V N S U Viswanath Ammu, R A Kumar, R N Chouhan, and A Agnihotri
27. "Special Hydrates/Alumina: Properties and Applications", IBAAS lecture series, July 28, 2023. S Rai,

**International Conference on Powder Metallurgy & Particulate Materials (PM-24), Pune 25-28th Feb 2024.**

28. Developing a Process for Producing Pilot-Scale Extrusion Billets from Machined Aluminium Alloy Swarf: A Step Towards Sustainable Aluminium  
Authors : N S Anas, K N Ramteke, R A Kumar, VNSU V, Ammu, R N Chouhan, A Agnihotri, R Radhakrishnan

**MetWaste-2024 3rd International Conference on Management and Recycling of Metallurgical Wastes 11-12 February 2024, IIT(BHU), Varanasi**

29. Towards Sustainable Copper Recycling: Techno-Economic Survey and Recommendations for a Circular Economy in India" Immanuel Raju Kola, Pradeep Gupta, Satish Dambhare, R N Chouhan, Anupam Agnihotri

**International analytical science congress 2024 (IASC – 2024) - 22-24 Feb 2024, Nagpur**

30. Utilizing XRF for Chemical Analysis of Minerals and Ores." P Nayar, A S Gijare, U Singh, A Agnihotri.
31. "Development of Ceramic Bricks from Manganese Mine Overburden Dump of Dongri, Buzurg, Maharashtra, India" Paparao Mondli, Kiran Janbandhu, Mohamed Najar, Upendra Singh and Anupam Agnihotri

## Events

**27<sup>th</sup> International Conference on Non-ferrous Metals (ICNFM-2023), Ranchi 07-08 July, 2023 Ranchi, India; ; [www.nonferrousmeet.net/](http://www.nonferrousmeet.net/)**

The 27<sup>th</sup> edition of the conference was successfully organized by Corporate Monitor in association with JNARDDC and MECON at Ranchi. The event focused on energy-efficient manufacturing technologies for primary and secondary non-ferrous metal extraction, showcasing innovative solutions for a sustainable future. A dedicated Satellite Session highlighted basic and applied research activities in energy-efficient non-ferrous metal manufacturing in India, providing a platform for experts to share their insights.



JNARDDC scientists made significant contributions, presenting three papers on their research findings. The conference saw an overwhelming response from industry leaders, including HINDALCO, BALCO, NALCO, Vedanta Aluminium, Hindalco-Birla Copper, Himadri Speciality Chemicals, Mitsui & Co, BARC, Innosat, MRAI, Hindustan Copper, Sterlite Copper, IIT-Kanpur, Uniseven Group, and many more. The esteemed gathering of experts and organizations underscored the importance of collaboration and knowledge sharing in driving innovation and sustainability in the non-ferrous metal industry."

### **Meet on “Geo-technological Evaluation of Bauxite deposits” JNARDDC 18<sup>th</sup> Aug, 2023**

A meeting was convened at JNARDDC to address various aspects and challenges related to bauxite deposits on 18<sup>th</sup> August 2023. The meeting focused on topics such as the scenario of lateritic bauxite deposits in India, the application of GIS and remote sensing technology, the quality of bauxite and laterite, and their applications in metallurgical and non-metallurgical sectors. Attended by over 60 participants from mines, industry, organizations, and academia, the event facilitated fruitful discussions. Chief Guest: Dr Gajanan Kamde, Director, Directorate of Geology & Mining (DGM), Maharashtra & Guest of Honour: Shri Bharat Sahoo, GM (Exploration), Orissa Mining Corporation graced the occasion.



### **Brainstorming session on “Quality and quantity assessment of plateau top lateritic bauxite using advance remote sensing technology” with NRSC-ISRO, 27-Oct 2023,**

JNARDDC, joined forces with the National Remote Sensing Centre (NRSC-ISRO), Hyderabad, to organize a significant brainstorming session on “Quality and Quantity Assessment of Plateau Top Lateritic Bauxite using Advanced Remote Sensing Technology” on 27<sup>th</sup> October 2023 at JNARDDC. With over 65 participants the technical discussions delved into the application of geospatial technology in bauxite mining, with special attention to unexplored lateritic bauxite deposits.



The use of advanced technology, such as hyperspectral remote sensing, took center stage in assessing ore body characteristics and quality. It was acknowledged that the application of hyperspectral remote sensing data is poised to revolutionize the identification of unexplored lateritic bauxite deposits.. This integration will streamline field exploration and sampling activities, ultimately contributing to the efficient evaluation of bauxite resources.

**41st International Conference and Exhibition (ICSOBA -2023); 5-8 Nov,2023 Dubai UAE**

The 41<sup>st</sup> ICSOBA-2023 conference organized by the International Committee for Study for Bauxite, Alumina and Aluminium at Dubai, UAE during 05-09 Nov 2023 was attended by JNARDDC scientists. Dr A Agnihotri, Director delivered the invited lecture on the topic - Sustainability of Indian Aluminium Sector Through Circular Economy. Dr U Singh, Sr Pr Scientist presented technical paper on “Production of Hydrogen using fine waste Aluminium dross: Secondary source of next generation Fuel” and Dr P G Bhukte, Pr Scientist presented technical paper on “A process for development of calcined bauxite from ferruginous bauxite



**Global Conference on Battery Recycling and Critical Minerals at Seoul, South Korea**

Dr. Agnihotri, Director JNARDDC was deputed by the Ministry of Mines for attending the Global Conference on Battery Recycling and Critical Minerals organized by the Ministry of Foreign Affairs, Republic of Korea at Seoul, South Korea during 30th November to 1st December, 2023. It was followed by an industrial visit. The event provided a great opportunity to share information on the global market status, technologies and various countries policies regarding battery recycling and critical minerals.



**11th International IBAAS-2023 Conference & Exhibition; International Bauxite, Alumina and Aluminium Society, Nagpur 04-06 Dec, 2023**

The 11th IBAAS was organized by IBAAS (International Bauxite, Alumina and Aluminium Society) in association with JNARDDC during December 4 - 6, 2023 at Chitnavis Centre, Nagpur, India. This was followed by a post conference visit to the HINDALCO's aluminium downstream facility of Mouda, near Nagpur on December 7, 2023. The theme of the IBAAS-2023 conference was "Latest Technological Developments in Alumina & Aluminium Production". This Conference covered the complete value chain of aluminium industry from bauxite evaluation / beneficiation to aluminium downstream products in three days of interactive meet.



The conference had series of technical presentations by leading Indian and the foreign experts. About 210 delegates from 95 companies / organizations from all over the world have participated. The experts were mainly arrived from India, Denmark, France, Germany, Russia, Switzerland, Sierra Leone and the USA. The conference was inaugurated by Mr. S. Kakananand, President & Head Manufacturing Centre for Excellence, HINDALCO along with Director JNARDDC, Dr. Anupam Agnihotri, Mr. Yves Ocello, a leading alumina expert of France, and Dr. Amit Chatterjee, Chief Research and Development Officer, VEDANTA. Dr Priyanka Nayar, Scientist of JNARDDC was awarded the first prize for the paper "Preparation of 2-Propanol Aluminium Salt (AIP) as an Intermediate for 4N pure alumina without employing a catalyst"

**International analytical science congress 2024 (IASC – 2024) – VNIT & JNARDDC, Nagpur 22-24 Feb 2024**

The International Analytical Science Congress 2024, IASC-2024 organized by ISAS and JNARDDC during 22-24 Feb 2024 was inaugurated in VNIT Auditorium by Chief Guest Shri Paradip Mukherjee, CEO, BRIT and Guest of Honour Dr. B. Sarvanan, Director AMD in presence of Dr Raghav Saran, President of ISAS, Dr. A Agnihotri, Director JNARDDC, Prof P M Padole, Director, VNIT and Dr. Rajesh S. Pande, Principal RCOEM.



The co-organizers were VNIT, RCOEM, ISRA, BARC, NEERI and TIFR. Scientists and researchers from all over India and international participants from Oman, Singapore etc participated in the interactive discussions covering modern analytical techniques in agriculture, space technology, pesticide and allied, food, food adulteration, geological materials, metallurgy, mining, mineral processing, petroleum refining, chemical and petrochemicals, pharmaceuticals and fine chemicals, forensics, bio-technology, nanotechnology, space technology, miniaturization coupled with automation, robotics and AI. A plethora of awards were given under various categories to motivate women and other young and veteran scientists. Dr Anupam Agnihotri was awarded the prestigious ISAS - Dr Raja Ramanna Award 2023 and Dr U Singh, HoD (Analytical) from JNARDDC was awarded the ISAS Analytical Scientist for the year 2023.

### Foundation day- 2023 & Technical session on Decarbonization

JNARDDC celebrated its 34<sup>th</sup> Foundation day on 21st April 2023. The event was inaugurated Chief Guest, Mr Ajit Kumar Saxena, CMD, MOIL Ltd. and Dr Anupam Agnihotri, Director, JNARDDC. Mr Saxena with a wide experience in steel sector appreciated JNARDDC for its achievements in the last 33 years and the efficient way the institute has adapted to the changes in the government policies. Mr MT Nimje, Dr Upendra Singh, Dr Md Najar, Dr Suchita Rai and Dr PG Bhukte were felicitated by Director, JNARDDC for their technical achievements in patent and publication. Mrs R Vishakha, Sr Admin Officer was awarded the employee of the year for 2022-23. The Coal Division, Spectro-Chemical & X-Ray Lab and CTSC were awarded certificate of appreciation for their invaluable contribution towards revenue generation activity. The inaugural session was followed by an address on “Decarbonization in Aluminium Sector” by Dr Sadhna S Rayalu, Chief Scientist, NEERI, Mr Shrikant P Dharmadhikari, NPTI and Dr Vijay S Yeul, Sr Chemist MAHAGENCO, Chandrapur. The session was summed up by Dr Anupam Agnihotri by highlighting the benefits of circular economy and emphasizing the key role JNARDDC will be playing as the Metal Recycling Authority (MRA) in the non-ferrous sector of aluminium, copper, lead and zinc. The event was attended by ex-employees and delegates from IBM, GSI, VNIT, CIMFR, NEERI, IBAAS, IDBI Bank, Yes Bank (sponsorer), PRIMUS, RGNIPM, USIA, NPTI, RCOEM, SMS India, TATA Advance System, Sterling Education System, MINEX, etc.



The Institute organized a blood donation camp in the second half in association with Indira Gandhi Government Medical College & Hospital (IGGMCH).



**Promoting Startups & MSMEs under S&T-PRISM Scheme**

JNARDDC, Nagpur has been nominated as the implementing agency for S&T-PRISM on behalf of the Ministry of Mines. - Based on the recommendation of TEC and approval of Apex Committee a total of five startups / MSMEs were shortlisted under the PRISM scheme. Shri Pralhad Joshi, Hon'ble Union Minister of Coal, Mines & Parliamentary Affairs handed over the letters of financial grants to selected five start-ups working in the Mining sector on 29th Feb 2024 at Pragati Vihar, New Delhi. For the first time, S&T(Mines) funding was extended towards start-ups and MSMEs with JNARDDC, Nagpur as the implementing agency in presence of Shri V L Kantha Rao, Secretary (Mines) & Chairman of Apex Committee & Dr A Agnihotri, Chairman, TEC.



- (1) Ashvini Rare Earth Private Limited, Pune
- (2) Caliche Private Limited, Shillong
- (3) Cellark Powertech Private Limited, Bhubaneswar
- (4) Ln Indtech Services Private Limited, Bhubaneswar &
- (5) Saru Smelting Private Limited, Meerut.

**Inauguration of labs at JNARDDC by Secretary (Mines)**

Shri V L Kantha Rao, IAS, Secretary(Mines) reviewed the activities of JNARDDC on 21.10.23. He inaugurated 3 new lab facilities (Fire Assay Lab for precious metals, Microscope & Microhardness tester of Downstream Lab) and participated in plantation program.



### India International Trade Fare IITF-2023

In order to create awareness among the general public about the path breaking reforms underway in the mining and mineral sector of India, the Ministry of Mines showcased a state-of-art Mining Pavillion with the theme “Connecting Beyond Mining” at the India International Trade Fare – 2023 (IITF) at Pragati Maidan, New Delhi from 14th to 27th November 2023.



The major attractions of the Mining Pavilion were Virtual Reality Experience bringing closer view of the mines, Kids Zone for spreading knowhow about Mines and Minerals through interactive games, Interactive Digital Communication inside the Pavilion and Workshops on Recycling. The JNARDDC workshops and Quiz on recycling received overwhelming response and the Mining Pavilion at the 42nd India International Trade Fair (IITF) 2023 won the Silver Medal for the "Most Popular Pavilion".

### PERC review & Thrust area meeting at JNARDDC

A review meeting of PERC (Project Evaluation & Review Committee) was held under the Chairmanship of Shri U C Joshi, Joint Secretary, Ministry of Mines during 25-26 May 2023 through VC mode. 17 completed and 42 ongoing projects were reviewed by the committee. JNARDDC team efficiently managed the 3 virtual meetings simultaneously.

Subsequently, the members of PERC (Project Evaluation & Review Committee) and other experts of SSAG met on 7<sup>th</sup> June 2023 under the Chairmanship of Shri U C Joshi, Joint Secretary, Ministry of Mines during the meeting held at JNARDDC to discuss the existing thrust areas of the S&T – research program scheme. All the members gave their suggestions with a view to reframe the thrust areas to include the latest developments in technological fields and make the S&T research program more effective. The R&D scheme was redesigned so as to shift the focus from fundamental research to industry oriented projects with time bound deliverables so that the R&D outputs could be scaled up and commercialized for the benefit of the end user and society at large.

### National Unity Week 25 to 31 October, 2023

The National Unity Week was celebrated from 25 to 31 October, 2023, as part of the “Meri Maati Mera Desh” campaign which was a unique and innovative way of celebrating the 77th anniversary of India's freedom. On 27th Oct 2023 Dr A Agnihotri, Director, JNARDDC, Dr Ishwar Das, Group Head, along with Ms Swati Singh of NRSC- ISRO, Hyderabad, Dr A K Nandi, Emeritus Scientist, Dr Ajay Deshpande and Dr Vivek Kale of MRSAC, Nagpur, Mr S Das, ORSAC, Bhubaneshwar, Mr R Anant Kumar, Assistant Vice President, Sterlite Power Transmission Ltd. And JNARDDC around 65 employees and staff took a pledge under “Meri Mati Mera Desh” program in National Unity Week. It’s a nationwide campaign to send the soil from their native places of historical significance to the Ministry of Culture. On 30<sup>th</sup> Oct 2023 the employees undertook the pledge to Say no to corruption and pledge their commitment to the Nation.



As a culmination event on the 31st October, 2023 in commemoration of the 148th birth anniversary of Sardar Vallabh bhai Patel – the Iron Man of India Dr Anupam Agnihotri, Director, JNARDDC administered the unity pledge in English and Hindi and flagged off the 3 km Run from Gate no.1 of JNARDDC Technical Campus which saw a enthusiastic participation of around 85 employees and external contractual staff.

### 63rd Central Geological Programming Board (CGPB)

The 63rd Central Geological Programming Board (CGPB) meeting was held on January 22, 2024, at the Kushabhau Thakre International Convention Centre (Minto Hall) in Bhopal. The meeting was chaired by Shri V L Kantha Rao, Secretary (Mines), and attended by Shri Pralhad Joshi, Hon'ble Union Minister of Coal, Mines & Parliamentary Affairs, and Dr Mohan Yadav, Hon'ble Chief Minister of Madhya Pradesh. Other participants included stakeholders from the mining and exploration sectors, along with the Principal Secretary, Additional Secretary (Mines), and State DMGs/DGMs from various Mining States.



Dr Anupam Agnihotri represented JNARDDC and engaged in productive discussions with several stakeholders. The MP State Mining Department also expressed interest in establishing a long-term MOU with JNARDDC for bulk sample analysis

### International Yoga Day

9<sup>th</sup> International Day of Yoga in 2023 was celebrated in JNARDDC with the theme "Yoga for Vasudhaiva Kutumbakam", which translates to "One Earth, One Family, One Future". The theme highlighted the universal appeal of yoga and the belief that its benefits are for all of humanity. All employees gathered and performed the yoga sequence in the office canteen under the guidance of yoga trainer.



### Welfare for Persons with Disabilities (PWD), Women, SC & ST.

The Centre is following the various government guidelines w.r.t PWD, SC, ST and OBC reservation. Recruitment of one OBC scientific post was completed. The process of filing up one post each of Junior Scientist against PWD, SC, ST & OBC are under process.

### Progressive use of Hindi

JNARDDC continued its efforts to promote the progressive use of Hindi. The Centre celebrated Hindi Pakhwada during 14-29 September 2023 which included several competitions. Director, JNARDDC emphasized the need for further use of hindi in day to day official use of the Centre's activities.



A Hindi workshop was organized at JNARDDC Auditorium on 17<sup>th</sup> August 2023 by Mr Ravi Shukla, renowned Hindi scholar and Head of the Hindi Department of Bharatiya Vidya Bhavan, Abu Dhabi, UAE. He threw light on various aspects of Hindi literature and working knowledge of Hindi.

### Vigilance Awareness Week organized at JNARDDC

Vigilance Awareness Week was observed from during 30<sup>th</sup> October to 5<sup>th</sup> November 2023. The CVO gave a detailed lecture on the theme "Say No to Corruption; Commit to the Nation". The weeklong program commenced with the employees taking the pledge to say no to corruption and their commitment to the nation. A sensitization program was carried out by the CVO for all HoDs and senior officers during this week



## Azadi ka Amrit Mahotsav



Government of India initiated Azadi Ka Amrit Mahotsav to celebrate and commemorate 75 years of progressive India and the glorious history of its people, culture and achievements. Keeping in line with the Govt initiative, JNARDDC has undertaken the following programs under AKAM.

Ministry of Mines & Ministry of Steel, Govt of India are working very assertively to make the metal sector more sustainable by introducing various policy reforms. Ministry of mines published “National Non-Ferrous Metal Scrap Recycling Framework-2020” and Ministry of Steel published “Steel Scrap Recycling Policy” to promote, organise and elevate the metal recycling in the country. Several policies have been drafted under circular economy actions which are under consultation with relevant stakeholders. To expedite the sustainable action and to bring awareness about sustainability in the metal sector, sustainability drive was linked with Azadi ka Amrit Mahotsav Program. Under the “Azadi ka Amrit Mahotsav-Circular Economy Campaign” Ministry of Mines and Ministry of Steel entrusted JNARDDC, MRAI, NALCO, MSTC and NMDC to organise 75 Metal Waste utilisation and Recycling campaigns across the country.

In this circular economy campaign total 52 industry events in 10 clusters with awareness conference themed “Sustainable & Circular Bharat: Towards Zero Waste in Metal Processing” were conducted. Five Academic linkages program with IIT, NIT, Engineering colleges, R&D institutes to discuss the technical issues in recycling & waste utilisation, and 27 school & college awareness programs were organised in the Vidarbha region of Maharashtra where awareness lecture, best out of waste, drawing and debate programs were organised. The event witnessed the presence of Hon’ble Minister of Mines and also top most bureacuates of Ministry of Mines and Steel.

These events received profuse response from the industry, academia and schools. Also, it witnessed participation from policy makers, government official, local bodies, state government, CPCB, Customs, etc. Representatives from Ministry of Mines and Ministry of Steel, JNARDDC, MRAI, NALCO, MSTC, NMDC were present during all the events to observe the industrial practices and to listen to the industry’s circular economy issues and challenges. A report was compiled of various events, summary of participation and various issues that need immediate attention of government to eliminate the barriers in implementing the circular economy in the metal sector.

**Glimpses of AKAM Circular Economy Campaign 2023-24**



**Shri Rasoahb Danveji, Hon'ble Minister of State for Railways & Coal at Jalna CE event**



**Ms. Poonamben Maadam, MP, Jamnagar & Devbhoomi Dwarka**



**Shri Lohit Matani, IPS, SP, Bhandara**



**Mr Ravindra Katolkar, DEO, Nagpur**



**Mr Dhanaji Patil Addl Collector I/c Gadchiroli**



**Ms S Buveneswari, IAS, Collector, Washim**

## Training Programs

1. 33 PG and Engineering students from PAN India 8 colleges were provided short term internship training program. They included students from Ambedkar College Nagpur, VNIT Nagpur, YCCE Nagpur, Government Polytechnic Nagpur, St. Francis De Sales College Nagpur, Hislop College Nagpur, COEP Technological University Pune and UIET CSJM University Kanpur
2. 3 employees (Dr Anas N S, Mr R Anil kumar and Mr S Mukherjee) successfully completed “Certificate Course & Workshop on Mechanical Testing of Materials” coordinated by the Department of Metallurgical and Materials Engineering at VNIT Nagpur in 2023
3. All employees registered on iGOT and they completed their earmarked courses as per CNA including the following six mandatory courses advised by DoPT. A total of 372 courses were completed in 2023-24.
  - a) Code of conduct for Government Employees.
  - b) Prevention of Sexual harassment of Women at workplace.
  - c) Introduction of Emerging Technologies.
  - d) Yoga Break at workplace.
  - e) Orientation Module on Mission Life.
  - f) Stay safe in Cyber Space.
4. JNARDDC provided Lab cum exposure visit to Ministry of Mines officials (ASO, SO, Legal Assistants, Consultants and Technical manpower). It provided an opportunity for all the dealing hands to visit the actual office sites of Ministry of Mines and enhance Annual Capacity Building Plan (ACBP) by getting onsite exposure of the labs and mines.



**3 batches of 10 officials completed the tour on 10th, 17th and 24th May 2023.**

## Awards / Achievements

Dr Anupam Agnihotri was awarded the prestigious ISAS - Dr Raja Ramanna Award 2023 and Dr U Singh, HoD (Analytical) from JNARDDC was awarded the ISAS Analytical Scientist for the year 2023.



Dr. Paparao Mondri, Sciencist received the best paper award by Indian Society of Analytical Scientists-2024 held at VNIT & JNARDDC, Nagpur



Dr Priyanka Nayar, Scientist of JNARDDC was awarded the first prize in 11<sup>th</sup> International IBAAS-2023 Conference & Exhibition; International Bauxite, Alumina and Aluminium Society, Nagpur 04-06 Dec, 2023 for the paper "Preparation of 2-Propanol Aluminium Salt (AIP) as an Intermediate for 4N pure alumina without employing a catalyst"

Dr Anas N S was appreciated as one of the best presenters for his oral presentation at the "International Conference on Metallurgical Engineering" organized by IIT-BHU during 26-28th Oct, 2023.





Mr Immanuel Kola Raju, Jr Scientist was awarded for the best oral presentation in the MetWaste-2024 3rd International Conference on Management and Recycling of Metallurgical Wastes 11-12 February 2024, IIT(BHU), Varanasi

Ms Prachi Pradhan, Junior Scientist presented a paper entitled “Membrane materials for energy production and storage” during Recent Trends in Energy & Fuel Production Technologies (RTEFPT-2024) held during 24-25 February, 2024 at Department of Chemical Engineering, Veer Surendra Sai University of Technology, Burla, Sambalpur, Odisha and bagged the best paper presentation award.

### Swachata pakhwada Awards 2023

JNARDDC undertook special campaign for cleanliness of all labs and office premises and Park with Nagpur Nagar Parishad. Swachata Pakhwara was observed in October 2023 with a view to encourage the zeal of the above program. JNARDDC undertook the following activities under SBM

- (i) Renovation of 2 nos. of Gents & Ladies toilets of Block-1 of JNARDDC office
- (ii) Renovation of D-1 & D-2 Guest House
- (iii) 18 days long SHS campaign with activities covering mass pledge, drive in office, roads and adjoining areas, labs, washrooms, a mega Shramdan campaign to clean local wadi Nagar Parishad Rani Laxmibai public park near National cleanliness Highway NH-6.



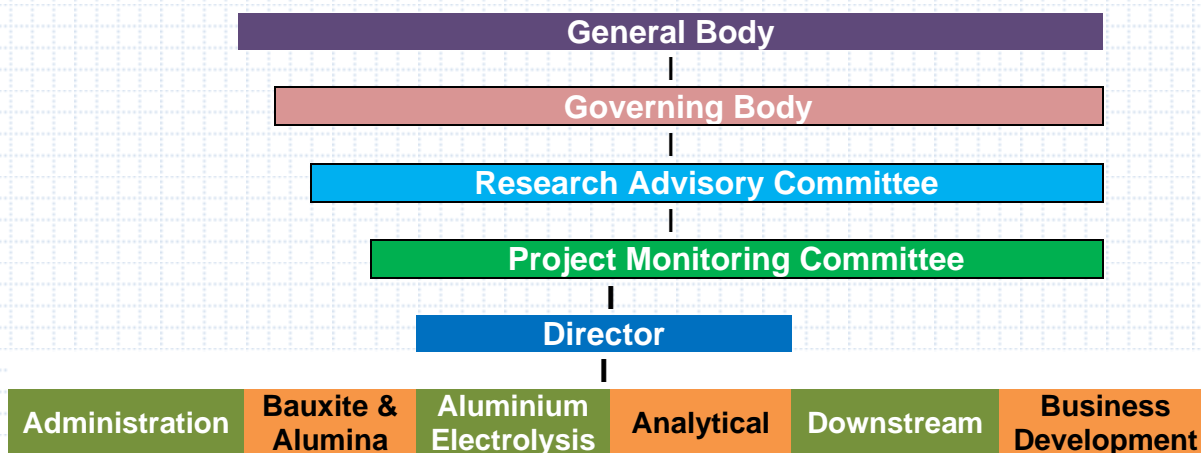
**JNARDDC secured 1st position in the Swachata pakhwada Awards 2023 for its exemplary performance adjudged by Ministry of Jal Shakti**

## JNARDDC Organizational Chart: 2023-24



**Shri V L Kantha Rao**, IAS, Secretary to the Government of India, Ministry of Mines is the **Ex-officio chairman** of the **General Body** and **Governing Body** of JNARDDC. CMD, NALCO is the Ex-officio Vice Chairman of JNARDDC. The other committees include the Research Advisory Committee (RAC) and Project Monitoring Committee (PMC) constituted by the Governing Body for monitoring R&D programs & projects of the Centre. The Centre is headed by the Director who is the principal executive officer.

The organization chart is as below:



**Vice Chairman  
JNARDDC**



**Sridhar Patra**  
CMD, NALCO

**Chairman  
Research  
Advisory  
Council (RAC)**



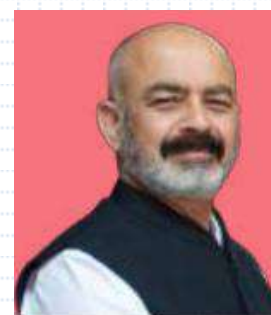
**Prof SP Mehrotra**  
IIT, Gandhinagar

**Chairman  
Project  
Monitoring  
Committee  
(PMC)**



**Prof S Subramanian**  
IISc, Bangalore

**Director  
JNARDDC**



**Dr Anupam  
Agnihotri**  
JNARDDC, Nagpur

## List of General Body Members: 2023-24

### Chairman

#### Shri V L Kantha Rao, IAS

Secretary to the Government of India  
Ministry of Mines, 3<sup>rd</sup> Floor, Shastri Bhavan  
Dr. Rajendra Prasad Road, New Delhi - 110001

### Members

- |   |   |
|---|---|
| <p>1. Shri Sridhar Patra<br/>Vice Chairman, JNARDDC<br/>Chairman-cum-Managing Director<br/>National Aluminium Company Limited,<br/>NALCO Bhawan, P/1, Nayapalli<br/>Bhubaneswar - 751 013</p> | <p>7. Shri Satish Pai<br/>Managing Director<br/>HINDALCO Industries Limited<br/>Aditya Birla Centre B-Wing<br/>3<sup>rd</sup> Floor, SK Ahire Marg, Worli<br/>Mumbai – 400030</p> |
| <p>2. Prof. Abhay Karandikar<br/>Secretary to the Govt of India,<br/>Department of Science &amp; Technology<br/>Technology Bhavan, New Mehrauli Road<br/>New Delhi - 110 016</p>              | <p>8. Shri Rajesh Kumar<br/>Chief Executive Officer<br/>Bharat Aluminium Company<br/>Limited, BALCO Nagar<br/>KORBA – 495684</p>  |
| <p>3. Dr (Mrs) N Kalaiselvi<br/>Director General, CSIR<br/>Council of Scientific &amp; Industrial Research<br/>Anusandhan Bhawan 2, Rafi Marg<br/>New Delhi - 110 001</p>                     | <p>9. Shri Sunil Gupta<br/>Chief Executive Officer<br/>VEDANTA Aluminium<br/>Vill.: Bhurkamunda<br/>Jharsuguda – 768 202, Odisha</p>  |
| <p>4. Sanjay Lohiya, IAS<br/>Additional Secretary to the Govt. of India,<br/>Ministry of Mines,<br/>3<sup>rd</sup>Floor, Shastri Bhavan<br/>New Delhi - 110001</p>                            | <p>10. Chairman-Managing Director<br/>Metallurgical &amp; Engineering<br/>Consultants (India) Limited,<br/>Doranda<br/>Ranchi - 834 002 (Jharkhand)</p>                           |
| <p>5. Shri Upendra C. Joshi, IRTS<br/>Joint Secretary to the Govt of India,<br/>Ministry of Mines<br/>3<sup>rd</sup>Floor, Shastri Bhavan<br/>New Delhi- 110001</p>                           | <p>11. Shri Abhay Bakre<br/>Director General<br/>Bureau of Energy Efficiency<br/>Ministry of Power<br/>New Delhi.</p>   |
| <p>6. Ms. Nirupama Kotru, IRS<br/>Financial Advisor to Government of India<br/>Ministry of Mines<br/>Shastri Bhavan<br/>New Delhi - 110001</p>  | <p>12. Dr Anupam Agnihotri<br/>Director<br/>Jawaharlal Nehru Aluminium<br/>Research Development and<br/>Design Centre Amravati Road,<br/>Wadi, Nagpur- 440 023</p>                |

## List of Governing Body Members: 2023-24

### Chairman

#### Shri V L Kantha Rao, IAS

Secretary to the Government of India  
Ministry of Mines, 3<sup>rd</sup> Floor, Shastri Bhawan  
Dr. Rajendra Prasad Road, New Delhi - 110001

### Members

- |   |   |
|---|---|
| <p>1. Shri Sridhar Patra<br/>Vice Chairman, JNARDDC<br/>Chairman-cum-Managing Director<br/>National Aluminium Company Limited,<br/>NALCO Bhawan, P/1, Nayapalli<br/>Bhubaneswar-751 013</p> | <p>8. Shri Abhay Bakre<br/>Director General<br/>Bureau of Energy Efficiency<br/>Ministry of Power<br/>4th Floor SewaBhawan, Sector-1<br/>RK Puram, New Delhi-110066</p> |
| <p>2. Sanjay Lohiya, IAS<br/>Additional Secretary to the Govt. of India,<br/>Ministry of Mines,<br/>3<sup>rd</sup> Floor, Shastri Bhawan<br/>New Delhi - 110001</p>                         | <p>9. Dr R Balamuralikrishnan<br/>Director<br/>Defence Metallurgical Research<br/>Laboratory, P.O. Kanchanbagh<br/>Hyderabad- 500 058</p>                               |
| <p>3. Shri Upendra C. Joshi, IRTS<br/>Joint Secretary to the Govt of India,<br/>Ministry of Mines<br/>3<sup>rd</sup> Floor, Shastri Bhawan<br/>New Delhi- 110001</p>                        | <p>10. Prof S P Mehrotra<br/>Indian Institute of Technology<br/>Gandhinagar, Palaj Campus,<br/>Gandhinagar, Ahmedabad – 382 424</p>                                     |
| <p>4. Ms. Nirupama Kotru, IRS<br/>Financial Advisor to Government of India<br/>Ministry of Mines<br/>Shastri Bhawan<br/>New Delhi - 110001</p>  | <p>11. Prof S Subramanian<br/>Department of Materials Engineering<br/>Indian Institute of Science<br/>Bangalore – 560 012</p>   |
| <p>5. Shri Rajesh Kumar<br/>Chief Executive Officer<br/>Bharat Aluminium Company Limited<br/>PO: BALCO Nagar KORBA – 495684<br/>Chhattisgarh</p>  | <p>12. Shri Bharat Kumar Sharma<br/>Member Secretary, CPCB<br/>Central Pollution Control Board<br/>Parivesh Bhawan, East Arjun Nagar<br/>Delhi – 110 032</p>            |
| <p>6. Shri Satish Pai<br/>Managing Director<br/>HINDALCO Industries Limited<br/>Aditya Birla Centre B-Wing, 3<sup>rd</sup> Floor,<br/>S.K. Ahire Marg, Worli, Mumbai – 400030</p>           | <p>13. Dr Anupam Agnihotri<br/>Director<br/>Jawaharlal Nehru Aluminium Research<br/>Development and Design Centre<br/>Amravati Road, Wadi, Nagpur - 440023</p>          |
| <p>7. Shri Sunil Gupta<br/>Chief Executive Officer<br/>VEDANTA Aluminium<br/>Vill.: Bhurkamunda<br/>Jharsuguda – 768 202, Odisha</p>  |   |

## List of Research Advisory Committee :2023-24

### Chairman

#### Prof. S.P. Mehrotra

Indian Institute of Technology, IIT Gandhinagar  
Palaj Campus, Gandhinagar  
Ahmedabad – 382 424 (Gujarat)

### Members

1. Prof S Subramanian  
Department of Materials Engineering  
Indian Institute of Science  
IISc  
Bangalore – 560 012
2. Dr Anita Agarwal  
Head (TDT) / Advisor,  
Department of Science & Technology,  
Technology Bhavan, New Mehrauli Rd,  
New Delhi- 110 016
3. Shri Jagdish Arora  
Director (P&T)  
National Aluminium Company Limited,  
NALCO Bhawan,  
P/1, Nayapalli,  
Bhubaneswar- 751 013
4. Shri Sunil Gupta  
Chief Executive Officer  
VEDANTA Aluminium  
Vill.: Bhurkamunda  
Jharsuguda – 768 202, Odisha
5. Mr S Nanda  
Ex-Director, HCL &  
Ex GM, NALCO  
Bhubaneshwar
6. Shri Rajesh Kumar  
Chief Executive Officer  
Bharat Aluminium Company Limited  
PO: BALCO Nagar KORBA – 495684  
Chhattisgarh
7. Shri Satish Pai  
Managing Director  
HINDALCO Industries Limited  
Aditya Birla Centre B-Wing  
3<sup>rd</sup> Floor, S.K. AhireMarg, Worli  
Mumbai – 400030
8. Shri Bharat C Sahoo  
Director (Exploration)  
Odisha Mining Corporation.  
7RFJ+96R, Gopabandhu Marg,  
Unit 4, Keshari Nagar,  
Bhubaneswar, Odisha 751001
9. Dr BK Satpathy  
Ex- ED (BD and R&D) , NALCO  
Plot No. 803  
Jaydev Vihar  
Bhubaneswar- 751 013 Odisha
10. Dr Anupam Agnihotri  
Director  
Jawaharlal Nehru Aluminium Research  
Development and Design Centre,  
Amravati Road, Wadi, Nagpur- 440 023

## List of Project Monitoring Committee: 2023-24

### Chairman

**Prof. S. Subramanian**  
Department of Materials Engineering  
Indian Institute of Science (IISc), Bangalore – 560 012

### Members

- |   |   |
|---|---|
| 1. Dr Anita Agarwal<br>Head (TDT) / Advisor,<br>Department of Science &<br>Technology, Technology<br>Bhavan, New Mehrauli Road,<br>New Delhi- 110 016 | 4. Dr. B.K. Satpathy<br>Ex- Executive Director, NALCO<br>Plot No. 803<br>Jaydev Vihar<br>Bhubaneswar- 751 013 Odisha  |
| 2. Prof. D.R. Peshwe<br>Head, Department of<br>Metallurgical & Materials Engg.<br>VNIT, Nagpur – 440 010  | 5. Mr S Nanda<br>Ex-Director, HCL &<br>Ex GM, NALCO<br>Bhubaneshwar   |
| 3. Shri Jagdish Arora<br>Director (P&T)<br>National Aluminium Company<br>Limited, NALCO Bhawan,<br>P/1, Nayapalli,<br>Bhubaneswar- 751 013            | 6. Dr. Anupam Agnihotri,<br>Director,<br>Jawaharlal Nehru Aluminium Research<br>Development and Design Centre<br>(JNARDDC)<br>Amravati Road, Wadi,<br>Nagpur- 440 023 |

## Scientists and Staff as on 31.03.2024

### Dr. Anupam Agnihotri, Director

#### Scientists: 16

Mr M T Nimje	HoD (AI Electrolysis)	Mr V K Jha	Senior Scientist
Mr R N Chouhan	HoD (DSP & Recy)	Dr Paparao Mondri	Scientist
Dr U Singh	HoD (Analytical)	Dr Priyanka Nayar	Scientist
Dr P G Bhukte	HoD (Bauxite)	Mr Ramavajjala Anil Kumar	Junior Scientist
Mr Amol Mankar	HoD (Alumina)	Ms Prachiprava Pradhan	Junior Scientist
Dr Md Najar P A	Principal Scientist	Mr Kola Immanuel Raju	Junior Scientist
Dr (Mrs) S Rai	Principal Scientist	Ms Jyoti G Pendam	Junior Scientist
Mr VNSU V Ammu	Senior Scientist	Dr Anas N S	Junior Scientist

#### Scientific & Technical Supporting Staff: 19

Mr S K Thokai	Sr Scientific Officer Gr-II	Mr Sandeep Kowe	Scientific Asst II
Ms K Janbandhu	Sr Scientific Officer Gr-II	Ms Naushin Ansari	Scientific Asst II
Mr N Warhadpande	Sr Scientific Officer Gr-II	Mr Suman Mukherjee	Scientific Asst I
Mr K J Kulkarni	Sr Scientific Officer Gr-I	Mr P Manthana	Technical Asst III
Ms M Panchal	Scientific Officer	Mr K B Gour	Technical Asst III
Mr D R Meshram	Scientific Asst IV	Mr V Kshirsaut	Technical Asst III
Mr A S Gijare	Scientific Asst IV	Mr S Yadav	Technical Asst II
Mr S Bagde	Scientific Asst III	Mr V P Naik	Technical Asst II
Mr Gopal Daware	Scientific Asst II	Mr Amit Palade	Lab Asst.
Ms Shweta Naik	Scientific Asst II		

#### Administrative Staff: 11

Mr R Srinivasan	Sr Admin Officer	Mr K Kishore	Sr Acct-Ch. Cashier
Ms R Vishakha	Sr Admin Officer	Mr Lalit Mohan	Sr Purch-Stores Asst
Mr S R Barhanpurkar	Personnel Officer	Mr P Kshirsaut	Jr Asst
Mr G Bhaskar	AAO (Accounts)	Mr Roshan Jasutkar	Jr Asst
Mr R K Meshram	Personnel Officer	Mr Ravi Dhande	Jr Asst
Mr N D Pethe	Personal Secy		

#### Supporting Staff: 4

Mr Ashok J Hatwar	Driver-cum-Lab Attendant Sr Grade
Mr R C Patley	Driver-cum-Lab Attendant Sr Grade
Mr Raju Khobrgade	Driver-cum-Lab Attendant Grade- I
Mr Deochand S Thakare	Peon-cum-Messenger

**Total Staff Strength: 52**

## New Equipments / Facilities

### Optical Microscope

Make: Leica

Model: DMI8C

Magnification: 25X, 50X, 100X, 200X, 500X and 1000X

Imaging modes: Bright field, Dark field, Ultra-Contrast and Polarising

Light source: LED

Description:

The microscope also comes with

software with advanced metallurgical

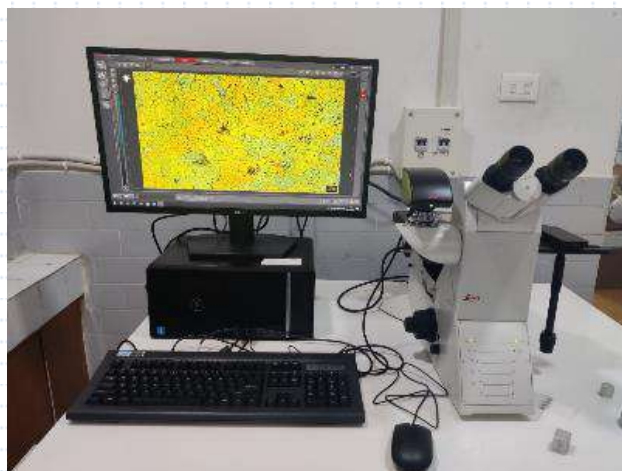
modules which are useful for grain size analysis, multi-phase and inclusion analysis,

feature counts, layer thickness measurement, etc. This microscope can work in

polarizing mode which is a powerful tool for examining grain size, texture, etc. provides a

non-destructive and highly informative to investigate the microstructure and

crystallography of aluminium alloys



### Thermogravimetric Analyzer

Make: Leco

Model: 801

Temperature range: Ambient to 1000°C

Applications: Thermogravimetric Analyzer determines weight loss, including moisture, ash, volatile content and Loss-on-ignition (LOI), in various organic, inorganic and synthetic materials. Weight change is measured as a function of temperature as samples are exposed to a temperature program in an atmosphere-controlled environment. The multi-sample furnace design allows for simultaneous analysis of upto 19 samples



### Bomb Calorimeter

Make: Parr, USA Model: 6400

GCV Range: Up to 8000 Cal/gram

Time of analysis: 7 – 8 minutes

Temperature resolution: 0.0001 °C

Applications: Automatic Isoperibol Calorimeter for coal analysis. This instrument incorporates a closed loop cooling subsystem into the Calorimeter, it also features the fixed bomb and bucket design allowing for automated bucket and jacket fill as well as automated vessel fill and rinse. It

requires one minute of operator time per test, allowing a technician to operate upto four Calorimeters simultaneously.



### Laboratory 1 Litre Autoclave



Make: Amar Equipment Pvt. Ltd., Mumbai

Maximum pressure: 100 bar

Maximum operating temperature: 375 °C

Capacity of vessel: 1 litre

Applications : The material of construction (MOC) for this vessel is Monel 400, which has excellent resistance to corrosive environments. The design pressure and temperature of the vessel are 100 bar and 425°C, respectively. This equipment is used for liquor preparation, desilication, digestion, and precipitation studies, which are vital processes in the alumina refinery.

### Retrofitting of 100 kN UTM

Make: Instron, USA

Model: 5582

Capacity: 100 KN UTM

Upgraded to Latest Controller to have load weighing system accuracy within +/- 0.5% of reading down to 1/1000th of the load cell capacity. Merlin software was upgraded to latest version of Bluehill. Crosshead movement is controlled by advanced Control Panel with Specimen protect. High rate of data acquisition for accurate results. Easy in synchronizing UTM hardware with Bluehill Software.



### Gravity Concentration (Shaking) Table

Make: Holmon -Wilfley

Ltd Model: Holmon -

Wilfley Model 800

Table Capacity: 75 kg/  
hour (max)



Application : The standard unit comprise with two decks for separation of coarse and finer particles. The function is to separate two or more materials mixed on the basis of their density. The equipment is useful for separation of minerals in bauxite, laterite, clay, red mud and other ores and materials.

### Laser Marking Machine

Make: Prakash Group, Faridabad

Model: Fibre laser marking  
machine

Applications:

Precise marking of logo and details on metallic and even 30% plastic materials is possible. JNARDDC will be using this machine for marking the aluminium CRMs that it manufactures and also in-house developed all-aluminium products like mobile stands, tablet stands, etc. Laser marking is very precise and fast



# ANNUAL ACCOUNTS

2023- 24



**Jawaharlal Nehru Aluminium Research Development & Design Centre**  
**Autonomous Body under Ministry of Mines, Govt. of India**  
**Amravati Road, Wadi, Nagpur – 440023**  
**[www.jnarddc.gov.in](http://www.jnarddc.gov.in)**

**AUDITED BY**

**CA** | **RAJAT MODI & CO**  
CHARTERED ACCOUNTANTS

CA.RAJAT MODI



**RAJAT MODI & CO.**  
**CHARTERED ACCOUNTANTS**  
 502, Suryakiran Complex, Opp. VNIT Gate  
 Abhyankar Nagar Square  
 NAGPUR-440010  
 Cell : 9370212220,7387186933  
 E-mail : rajatmodica@gmail.com

REPORT OF AN AUDITOR RELATING TO ACCOUNTS AUDITED UNDER  
 SUB-SECTION (2) OF SECTION 33 & 34 AND RULE 19 OF BOMBAY PUBLIC TRUST ACT.

Registration No. : F -6778 (NAGPUR)

Name of Public Trust : **JAWAHARLAL NEHRU ALUMINIUM RESEARCH  
 DEVELOPMENT AND DESIGN CENTRE : NAGPUR**

(An Autonomous Body Under Ministry of Mines, GOI. )

Amravati Road Wadi, Opp. Wadi police station Nagpur

Post : Wadi (440 023)

For the year ending : **31st March 2024**

(a)	Whether accounts are maintained regularly and in accordance with the provisions of the Act and the rules	YES
(b)	Whether receipts and disbursements are properly and correctly shown in the accounts	YES
(c)	Whether the cash balance and voucher in the custody of the manager or trustee on the date of audit were in agreement with the account	YES
(d)	Whether all books, deeds, accounts, vouchers or other documents or record required by the auditor were produced before him	YES
(e)	Whether a register or movable and immovable properties is properly maintained, the changes therein are communicated from time to time to the regional office and the defects and inaccuracies mentioned in the previous audit report have been duly complied with	YES
(f)	Whether the Manager or trustee or any other person required by the auditor to appear before him did so and furnished the necessary information required by him	YES
(g)	Whether any property or funds of the Trust were applied for any object or purpose other than the object or purpose of the Trust	NO
(h)	The amount of outstanding for more than one year	YES
(i)	The amounts written off if any	YES
(j)	Whether tenders / quotation were invited for repairs or construction involving expenditure exceeds Rs.25,000/-	YES
(k)	Whether any money of the public trust has been invested contrary to the provisions of Section 35	NO
(l)	Alienations. If any, of the immovable property contrary to the provisions of Section 36 which have come to the notice of the auditor	NIL

**JAWAHARLAL NEHRU ALUMINUM  
RESEARCH DEVELOPMENT & DESIGN CENTRE**

**2023-24**

(m)	All cases of irregular, illegal or improper expenditure, or failure or omission to recovery moneys or other property belonging to the public trust or of loss or waste of money or other property thereof, and whether such expenditure, failure, omission, loss or waste was caused in consequence of breach of trust or misapplication or any other misconduct on the part of the trustees or any other person while in the management of the trust.	NIL
(n)	Whether the budget has been filed in form provided by rule 16-A	YES
(o)	Whether the maximum and minimum number of the trustees is maintained	YES
(p)	Whether the meeting are held regularly as provided in such instrument	YES
(q)	Whether the minute of books of the proceedings of the meeting is maintained	YES
(r)	Whether any of the trustees has any interest in the investment of the trustees	NO
(s)	Whether any of the trustees is a debtor or creditor of the trust	NO
(t)	Whether the irregularities pointed out by the auditors in the accounts of the previous year have duly complied with by the trustees during the period of audit	YES
(u)	Any special matter which the auditor may think fit or necessary to bring to the notice of the Deputy or Assistant Charity Commissioner	NO

**For RAJAT MODI & CO.  
Chartered Accountants**

**Place : NAGPUR  
Date : 28.11.2024**

**CA RAJAT MODI  
PARTNER  
Mem No. : 161252  
FRN : 126024W**

CA. RAJAT MODI



**RAJAT MODI & CO.**  
**CHARTERED ACCOUNTANTS**  
 502, Suryakiran Complex, Opp. VNIT Gate  
 Abhyankar Nagar Square  
 NAGPUR-440010  
 Cell : 9370212220,7387186933  
 E-mail : rajatmodica@gmail.com

**THE BOMBAY PUBLIC TRUSTS ACT 1950**  
**SCHEDULE IX C**

**Statement of income liable to contribution for the year ending 31st March 2024**

**Name of Public Trust : Jawaharlal Nehru Aluminium Research Development  
 and Design Centre Nagpur.**

**Registration No. : F-6778 (NAGPUR)**

		Rs.	Rs.
I	Income as shown in the Income and Expenditure Accounts : ( Schedule IX)		33,88,24,083
II	Items not chargeable to contribution under sec.58 and Rule 32 :		
	i.) Donations received from other Public Trusts and Dharmaday	NIL	
	ii) Grants Received from Government & Local Authorities	10,19,20,316	
	iii) Interest on Sinking or Depreciation Fund	NIL,	
	iv) Amount spent for the purpose of secular education	NIL	
	v) Amount spent for the purpose of Medical relief	NIL	
	vi) Amount spent for the purpose of veterinary treatment of Animals	NIL	
	vii) Expenditure incurred from donation for relief of distress Caused by scarcity, drought, flood, fire or other natural Calamity	NIL	
	viii) Deductions out of income from lands used for Agricultural purposes:	NIL	
	(a) Land Revenue local Fund Cess	NIL	
	(b) Rent Payable to superior land lord	NIL	
	(c) Cost of production, if lands are cultivated by Trustee	NIL	

JAWAHARLAL NEHRU ALUMINIUM RESEARCH  
DEVELOPMENT & DESIGN CENTRE ,NAGPUR

( F Y : 2023-24 )

ix). Deductions out of income from lands used for non Agricultural purposes :	NIL	
(a) Assessment, Cess and other Government or Municipal Taxes, Land tax etc	80,620/-	
(b) Ground rent payable to the superior landlord	NIL	
(c) Insurance Premium	NIL	
(d) Repairs at 10 percent of gross rent of building	NIL	
(e) Cost of collection 4 percent of gross rent of building let out	Nil	
(x) Cost of collection of income or receipts from Securities, stocks etc. At 1 percent of such income	NIL	
(xi) Deductions on account of repairs in respect of building not rented and yielding no income at 10 percent of the estimated	NIL	
Gross Annual Income Chargeable to advance Contribution ( Payable to Dy Charity Commissioner)		<b>23,69,03,767</b>

Certified that while claiming deductions admissible under the above schedule, the Trust has not claimed any amount twice, either wholly or partly, against any of the items mentioned in the Schedule which have the effect of double deductions.

**For RAJAT MODI & CO.  
Chartered Accountants**

**Place : NAGPUR  
Date : 28.11.2024**

**CA RAJAT MODI  
PARTNER  
Mem No. : 161252  
FRN : 126024W**

CA.RAJAT MODI



**RAJAT MODI & CO.**  
**CHARTERED ACCOUNTANTS**  
 502, Suryakiran Complex, Opp. VNIT Gate  
 Abhyankar Nagar Square  
 NAGPUR-440010  
 Cell : 9370212220,7387186933  
 E-mail : rajatmodica@gmail.com

**NAME OF THE PUBLIC TRUST:**  
**JAWAHARLAL NEHRU ALUMINIUM RESEARCH DEVELOPMENT &**  
**DESIGN CENTRE NAGPUR**  
 (Autonomous Body under Ministry of Mines, Govt of India)  
 Reg No. F -6778 (NAGPUR)  
 As On 31.03.2024

**"SCHEDULE IX-D"**

[See Rule 19 (2A)]

Information to be submitted by the Auditor along with Audit Report under sub-section (1) of section 34 of the Maharashtra Public Trust Act.

SN	Particulars	Details		
1	PAN No. of Trust	AAATJ2814M		
2	Registration No. with Date of Registration u/s 12AA of Income Tax Act, 1961 (43 of 1961)	CIT- IV 12A / P-217/P-2007-08 dated 22.11.2007		
3	Acknowledgement No. With Date of filing of the Return of Income for Earlier Three Years	<b>Sr. No.</b>	<b>Acknowledgement No.</b>	<b>AY Year</b>
		1	350879980140322	AY 2021-22
		2	786209660071122	AY 2022-23
		3	5347723203011123	AY 2023-24
4	PAN of All Trustees	<b>Sr. No.</b>	<b>Name Of Trustee</b>	<b>PAN No.</b>
		1	Dr Anupam Agnihotri (Director)	ABCPA8526E
		2	R Srinivasan (Secretary)	AQIPS8639P
		3	All others are Ex-Officio	-

Place : NAGPUR  
 Date : 28.11.2024

**For RAJAT MODI & CO.**  
**Chartered Accountants**  
**CA RAJAT MODI**  
**PARTNER**  
 Mem No. : 161252  
 FRN : 126024W

THE BOMBAY PUBLIC TRUST ACT-1950  
SCHEDULE VIII ( WIDE RULE (17)(1))  
NAME OF THE PUBLIC TRUST: JAWAHARLAL NEHRU ALUMINIUM RESEARCH DEVELOPMENT & DESIGN CENTRE NAGPUR (Autonomous Body under Ministry of Mines ,Govt of India)

Balance Sheet as at 31.03.2024 [ 2023-24 ]

LIABILITIES & ADVANCES	SCH	AMOUNT	PROPERTY AND ASSETS	SCH	AMOUNT	AMOUNT (₹)
<b>Trust Funds or Corpus :-</b> Balance as per last Balance Sheet Add : For life Membership		- -	<b>Fixed Assets :-</b> Balance as per last Balance Sheet Add : Immovable - Movable Properties	C C	22,72,41,226 2,57,91,846	25,30,33,073
<b>Other Earmarked Funds :-</b> As per last Balance sheet c/f Add: (Govt Grant - Capital S&T ) Add: (Govt ARA Capital fund) (Created under the provision of the trust deed or scheme or out of the Income) Depreciation Fund Sinking Fund Reserve Fund		72,99,14,667 6,92,00,000 13,53,41,000 - - -	<b>Utensils :-</b> Balance as per last Balance Sheet Additional during the year Less : sales during the year Depreciation up to date		- - - -	-
<b>Loans (Secured or Unsecured) :-</b> From Trustees: Balance as per last Balance Sheet Add: during the year From Other		- - -	<b>Income / Other Outstanding :-</b> Rent Interest Others (Sundry Debtors)	D	- - 25,13,40,198	25,13,40,198
<b>Liabilities :-</b> For Expenses For Advances Rent and Other Deposits Sundry Credit Balance	A B	- - 6,09,37,568 6,43,44,617	<b>Investments :-</b> TDR With YES Bank TDR with IDBI Bank Add : Accrued Interest		18,86,54,080 8,51,91,971 -	27,38,46,051
<b>Provision :-</b> Balance as per last Balance Sheet Add: during the year (Audit Fees) Paid during the year		- - -	<b>Cash and Bank Balances :-</b> a) Cash In Hand b) BANK BALANCE AS PER SCH c) with the trustee d) with the Manager	E	- 2,74,23,931 - -	2,74,23,931
<b>Income and Expenditure Account :-</b> Bal. as per last Balance Sheet Less : Appropriation , if any Add : Surplus Less : Deficit (As per I & E A/c)		- - -	<b>Income and Expenditure Account :-</b> Bal. cf as per last Balance Sheet Less : Surplus as per Income & Expenditure A/c of current year		35,14,33,511 (9,73,38,912)	25,40,94,599
<b>Total</b>		<b>1,05,97,37,852</b>	<b>Total</b>		<b>1,05,97,37,852</b>	<b>1,05,97,37,852</b>

As per our report of even date attached . The above balance sheet to the best of my/our belief contain a true account of the funds & liabilities and of the property and Assets of the trust

AS PER OUR REPORT OF EVEN DATE ATTACHED

For RAJAT MODI & Co  
Chartered Accountant

For Jawaharlal Nehru Aluminium Research Development & Design Centre :Nagpur

CA RAJAT MODI  
Partner

Mem No.161252 , FRN:126024W

V.L.KANTHA RAO  
CHAIRMAN

ANUPAM AGNIHOTRI  
DIRECTOR

R SRINIVASAN  
Secretary cum Sr Admin Officer

0

**[ 23-24 ]**  
**RENT AND OTHER DEPOSIT**

**SCHEDULE-A**

Prev. year	Particulars	(Amt. in ₹)
13565867	Earnest Money Deposit	14244917
199669	Rajesh S Badkhal	203018
227867	Media Elevators & Engg Co.	111103
428697	Mayur Services	186746
330058	Ganga Security	0
2950000	SMS India Pvt Ltd	2950000
830610	Sameer Ghadge	0
4425	Phoenix Power Nagpur	0
18750	Masibus Automotion Gujrat	18750
390265	Orbit Technology Pvt Ltd Hyderabd	2675000
2291400	Thermo Fisher Mumbai	2291400
315000	Kinc Mineral Technology	0
735926	Naskar & Company	0
49200	Matrix Trade Link Pvt Tld	49200
3272800	DHR Holding India Pvt Ltd	75000
2957400	Mitutoya South Asia Pvt Ltd	86022
2112308	MD Minerals Tech Pvt Ltd	257131
4600000	Instron USA	0
660800	Chhattisgarh Council of Science Raipur	0
63000	Unique Automation Nagpur	63000
0	Shri Krishna Enterprises	200000
0	Creative Concer Nagpur withheld	185962
0	Labchem Scientific Nagpur	1440678
0	Spectris Technologies Pvt Ltd	21492861
0	Spectralytic Scientific India Pvt Ltd Mumbai	14406780
<b>36004042</b>	<b>SUB TOTAL (1)</b>	<b>60937568</b>

Prev. year	SUNDRY CREDITORS / OTHER LIABILITIES Particulars	SCHEDULE-B (Amt. in ₹)
25000	Audit Fee Payable	25000
44820543	Outstanding Liabilities (ANNEXURE B-1)	55361097
1990	Employees EPF cont	0
8300398	TDS As per 26 AS ded by Various Parties	8947396
6800	Star Health claim payable to staff	11124
<b>53154732</b>	<b>SUB TOTAL (2)</b>	<b>64344617</b>
<b>8,91,58,774</b>	<b>GRAND TOTAL(1+2)</b>	<b>12,52,82,185</b>

[ 23-24 ]

<b>OUSTANDING LIABILITIES AS ON 31/3/2024</b>		
<b>Prev. year</b>	<b>Particulars</b>	<b>(Amt. in ₹ )</b>
18399	Water charges bill	0
212768	Rajesh S Badkhal for Gardening contract	0
206274	Media Elevator co ltd for Elect contract	0
11238	Telephone charges	0
476324	Mayur Service Housekeeping Contract	0
553321	Electricity charges	0
593632	Ganga Security services	0
36292928	LIC Group Gratuity Trust JNARDDC A/c	44518000
6455659	G S T	10843097
<b>4,48,20,543</b>	<b>Total Outstanding Liabilities</b>	<b>5,53,61,097</b>

ANNEXURE 'C' OF FIXED ASSETS ATTACHED TO & FORMING PART OF BALANCE SHEET AS AT 31ST MARCH-2024										SCHEDULE - C			
Particulars (₹)	Rate of Dep %	Gross Block		Depreciation		Net Block		(Amt. in ₹)					
		Cost as at 01.04.2023	Additions upto 31.03.2024	Deletions 31.3.2024	Adjustments 31.3.2024	Cost as at 31.03.2024	Dep for the year upto 31/3/2024	Dep on sold items	Adjustments	Dep as at 31.03.2024	Cost as at 31.03.2024	Cost as at 31.03.2023	
<b>Immovable properties</b>													
Technical Buildings	3.34	51991705	0	0	0	48966707	1736523	0	50703230	1288475	3024998		
Office Buildings	1.63	15044525	0	0	0	7142458	245226	0	7387684	7656841	7902067		
Land		2615177	0	0	0	0	0	0	0	2615177	2615177		
Fire Fighting System	4.75	1270062	0	0	0	1270062	0	0	1270062	0	0		
Electrical Installation	3.34	21812357	0	0	0	20386489	728533	0	21115022	697335	1425868		
Residential Buildings	1.63	31442316	0	0	0	13235424	512510	0	13747934	17694382	18206892		
Large Scale Alumina Lab	4.75	6949295	0	0	0	6949295	0	0	6949295	0	0		
Air Conditioning	4.75	5082690	0	0	0	4893364	189326	0	5082690	0	189326		
Sub Total-I		136208127	0	0	0	102843799	3412118	0	106255917	29952210	33364328		
Previous Year		136208127	0	0	0	99379579	3464220	0	102843799	33364328	36828548		
<b>Movable Properties</b>													
Motor Vehicles	11.31	5551497	2016673	0	0	7568170	853986	0	6405483	1162687	0		
Furnitures and Fixtures	6.33	5313197	0	0	0	5313197	0	0	5313197	0	0		
Office Equipments	4.75	2533985	0	0	0	2533985	118390	0	2533985	0	118390		
Telecommunication system	4.75	2021667	0	0	0	1975121	46546	0	2021667	0	46546		
Books and Periodicals	100	5274469	0	0	0	5274469	0	0	5274469	0	0		
Lab Equipments Installed	4.75	144017447	0	0	0	138884432	6840829	0	14275261	1292186	8133015		
Lab equip S & T (Govt Grants)	4.75	91308918	16550438	0	190265	15119265	5114282	0	20233547	87435545	76189653		
Lab Equip (Nalco Capital)	4.75	21601319	0	0	0	10992522	1026063	0	12018585	9582734	10608797		
Lab Equip (Modrobs)	4.75	18772746	0	0	0	12140929	891705	0	13032634	5740112	6631817		
Lab equipment under(DPR Grant)	4.75	105779406	0	0	0	29546257	5024522	0	34570779	71208627	76233149		
Lab equipment DST P-55	4.75	4460171	0	0	0	1271148	211858	0	1483006	2977165	3189023		
Lab Equipments not Installed		12726508	43681807	12726508	0	43681807	0	0	0	43681807	12726508		
Computers	16.21	6210502	0	0	0	6210502	0	0	6210502	0	0		
Technical research equip(UNDP)	4.75	70484011	0	0	0	70484011	0	0	70484011	0	0		
Sub Total-II		496055842	62248918	12726508	190265	545387987	20128181	0	322307126	223080863	193876998		
Previous Year		440747578	27050544	0	0	440747578	16425470	0	266566915	193876899	174180664		
<b>Grand Total(Sub Total I+II)</b>		<b>632263969</b>	<b>6,22,48,918</b>	<b>12726508</b>	<b>190265</b>	<b>681596114</b>	<b>405022744</b>	<b>0</b>	<b>428563043</b>	<b>25,30,33,073</b>	<b>22,72,41,226</b>		

## SCHEDULE : D - 1/2

[ 23-24 ]

PRE YEAR	PARTICULARS	(Amt. in ₹ )
	<b>1. SUNDRY DEBTORS</b>	
658123	National Aluminium Co Ltd	269187
1060089	M E C L Nagpur	6622234
30817	NEERI	30817
(22140)	Ceraflux India Pvt Ltd	(20960)
0	Ministry of Mines (ARA Fund) receivable	155341000
93996	Bry Air Asia Pvt Ltd	111426
8850	Phonix Amalgams Pvt Ltd	8850
513536	Hindalco Industries Ltd Belgavi/Lapanga etc	157016
(8555)	Castwel Industries	(5605)
31394	MPM Durms Refracoat Pvt Ltd	104124
8040	Calderys India Refractories Ltd	(3110)
11800	Brisil Technologies Pvt Ltd	32450
3430	Gujrat Credo Alumina Chemical Ltd Katch	3430
(1818750)	Received from other party coal sample etc	(1888887)
37211	Carborundum Universal Ltd kerla	60076
(1180)	Unijules Life Sciences Ltd	(2360)
30682	M S P G C Ltd Bhusawal	30682
21240	CSRI Adv MPRI Bhopal	21240
775967	Odisha M E Corp Ltd Bhubaneswar	8213021
1060	Jindal Steel and and power limited	0
(3760)	SLM Metal Pvt Ltd	(3760)
133622	Thriveni Earmovers Pvt Ltd	133622
4791400	G S I Hyderabad etc	16650400
82770	MOIL Limited	82770
30569546	Receivable from Coal Sample testing	30648366
700445	Receivable amt from CTSC Invoice bill	(7087699)
0	Gujarat Mineral Development Corp Ltd	22000
0	Daiki Aluminium Industry India Pvt Ltd	23729
0	Kimberlite Chemical India Pvt td	516250
<b>3,77,09,633</b>	<b>(Total ' 1 ')</b>	<b>21,00,70,311</b>

[ 23-24 ]  
2). INVENTORIES

## SCHEDULE : D- 2/2

138671	2) STORES( Closing Stock)	69257
--------	---------------------------	-------

PRE YEAR	PARTICULARS	AMOUNT
375448	3) Departmental Advances (Annx D-3)	179387

PRE YEAR	4) (Advances / Deposit )	(Amt. in ₹ )
109000	Telephone Deposit	109000
315000	Deposit with MSEB	315000
102410	Deposit with M.S.Water Board	102410
24178479	TDS Amt receivables from I tax office	37809932
1157603	Deposit with MSEB for EP Connection	1157603
630000	Adv to Unique Automation Nagpur	0
197297	Adv to Jeol Ltd	197297
96500	Adv to Mohil Chordia Nagpur	0
1756889	Prepaid expenses	0
308746	Adv to Anna University	0
4000	Adv to TCI Freight	4000
(29500)	Adv to Dhruvi Creation	(29500)
(320339)	Adv to Sterling Education	0
0	Adv to Yogi Exim Surat	1101294
0	Adv to Balmer Lawrie	200000
0	Adv to Patni Auto	11708
0	Adv to Sahaj Infotech Delhi	31500
0	Adv to Maruti Suzuki	11000
28506084	(TOTAL-4)	41021243
6,67,29,836	TOTAL 1 TO 4	25,13,40,198

[ 23-24 ]		SCHEDULE D-3
PRE YEAR	DEPARTMENTAL ADVANCES- EMPLOYEES	(Amt. in ₹ )
26000	Upendra Singh	0
0	Vimal Kishore Jha	119211
6698	TA Adv Project staff	4436
7750	Prabhakar Hedao	2440
335000	Suchita Rai	0
0	Vinod Kshirsaut	3900
0	Raju Khobragade	5000
0	Paparao Mondi	42000
0	Gopal Daware	2400
<b>3,75,448</b>	<b>Total</b>	<b>1,79,387</b>

#### Breakup Schedule-D

37709633	1. SUNDRY DEBTORS	210070311
138671	2. STORES( Closing Stock)	69257
375448	3. Departmental Advances (Annx D-3)	179387
28506084	4. PARTICULARS(Advances/Deposit)	41021243
<b>6,67,29,836</b>	<b>Grand Total SCH-D</b>	<b>25,13,40,198</b>

#### 5) CASH & BANK BALANCES

#### SCHEDULE-E

PRE YEAR	PARTICULARS	(Amt. in ₹ )
1579	Cash in Hand	0
112611	I D B I Bank Ltd Nagpur (392)	(33,70,386)
9136	Axis Bank Limited, Nagpur	0
425737	YES Bank Saving A/c (764)	1,22,22,159
767499	IDBI Online A/c No.(4688)	(6,42,706)
271811	State Bank of India Ravinagar	4,86,864
0	IDBI S & T Prism A/c (47083)	1,87,28,000
<b>15,88,373</b>	<b>(TOTAL-5)</b>	<b>2,74,23,931</b>

CA.RAJAT MODI



**RAJAT MODI & CO.**  
**CHARTERED ACCOUNTANTS**  
502, Suryakiran Complex, Opp. VNIT Gate  
Abhyankar Nagar Square  
NAGPUR-440010  
Cell : 9370212220,7387186933  
E-mail : rajatmodica@gmail.com

**JAWAHARLAL NEHRU ALUMINIUM RESEARCH DEVELOPMENT  
AND DESIGN CENTRE: NAGPUR**

SIGNIFICANT ACCOUNTING POLICIES AND NOTES ON ACCOUNTS  
ATTACHED TO BALANCE SHEET AS ON 31<sup>ST</sup> MARCH, 2024

**PART A: SIGNIFICANT ACCOUNTING POLICIES**

1. The Centre is following Mercantile System of Accounting
2. Depreciation is provided on assets put to use, on Straight Line Method as per the rates specified under the Companies Act, 1956.
3. Fixed Assets are stated at cost of acquisition, inclusive of freight, Octroi, Duties and taxes and incidental expenses related to the acquisition.

**PART B: NOTES ON ACCOUNTS**

1. The Centre being established as an R & D Centre is not self-sufficient. The expenditure over and above the income generated is bridged by the Revenue Grant provided by the Government of India. The depreciation on assets put into use is not reimbursed in the Revenue Grant.
2. The excess of income over expenditure amounting to ₹ 9,73,38,912/- has been carried over as surplus to Balance Sheet and set off against the accumulated loss / deficit of earlier years.
3. Since this is a trust with registration under section 12(A)(a) of IT Act-1961, Income tax is not payable.
4. Previous year figures have been regrouped wherever necessary.
5. Salary & Projects grants are released by Ministry of Mines, Govt of India on Quarterly basis normally. Thus, the Centre utilizes the available funds/ Grants (which is received for specific purposes) on temporary basis to meet the various committed expenditure which are recouped later on receipt of the allocated budget.

**For RAJAT MODI & Co**  
**Chartered Accountants**

**For Jawaharlal Nehru Aluminium Research Development  
& Design Centre, Nagpur**

( CA Rajat Modi )  
**Partner**  
Member No. 161252  
F.R.No. 126024W

( R SRINIVASAN )  
**Secretary cum Sr Admin Officer**

( ANUPAM AGNIHOTRI )  
**Director**

( V.L. KANTHA RAO )  
**Chairman**

THE BOMBAY PUBLIC TRUST ACT-1950  
SCHEDULE IX (VIDE RULE (17(1))  
NAME OF THE PUBLIC TRUST: JAWAHARLAL NEHRU ALUMINIUM RESEARCH DEVELOPMENT & DESIGN CENTRE NAGPUR (Autonomous Body under Ministry of Mines, Govt. of India)

**Income and Expenditure Account for the year ending 31.03.2024 [ 2023-24]**

EXPENDITURE	SCH	(Amt. in ₹)	(Amt. in ₹)	INCOME	SCH	(Amt. in ₹)	(Amt. in ₹)
<u>To Expenditure in respect of properties :-</u>							
Rates, Taxes, Cesses	F	80,620		By Rent (Accrued) (realised)		-	-
Repairs and maintenance	G	47,06,666		By Interest (Accrued)		-	-
Salaries		13,10,10,119		Interest on FDR & SB A/c		72,72,896	72,72,896
Insurance		1,20,449		On securities		-	-
Depreciation		2,35,40,299		On Loans		-	-
Other Expenses	H	77,15,746	16,71,73,899	On Bank account		-	-
To Audit Fees / Expenses		25,000		By Dividend		-	-
To Printing & Stationery Expenses		1,31,945		By Donations in cash or kind		-	-
To Postage & courier charges		1,18,384		By Donation from Trustees		-	-
To Project expenses	I	7,35,08,637	7,40,42,032	By Grants	K	10,19,20,316	10,19,20,316
To Travelling Expenses		2,58,065		<u>By Income from other sources</u>			
To Provision for Audit Fees & IT return fees				Technical Testing Fee	L	20,36,40,983	
To Miscellaneous Expenses	J	2,69,241	2,69,241	Income from Research Projects	M	1,42,87,711	
To Depreciation		-	-	Miscellaneous Receipts	N	36,02,177	
To Amount transferred to Reserve/specific		-	-	Technical Seminars / Training		81,00,000	
<u>To Expenditure on object of the Trust :-</u>				Prior Period Income Against S Debtor		-	
a. Religious				By Amount Written off		-	
b. Educational				By Contribution For Visit		-	
c. Medical Relief				c/f		-	
d. Relief of poverty				<b>TOTAL</b>		<b>33,88,24,083</b>	<b>33,88,24,083</b>
e. Other Charitable objects							
EXCESS OF INCOME OVER EXPENDITURE		9,73,38,912	9,73,38,912				
CARRIED OVER TO BALANCE SHEET							
<b>TOTAL</b>		<b>33,88,24,083</b>	<b>33,88,24,083</b>				

AS PER OUR REPORT OF EVEN DATE ATTACHED  
FOR RAJAT MODI & CO

For Jawaharlal Nehru Aluminium Research Development & Design Centre.

C.A. RAJAT MODI  
PARTNER  
Member No. 161252 FRN.126024W  
UDIN : \_\_\_\_\_

V.L. KANTHA RAO  
CHAIRMAN

ANUPAM AGNIHOTRI  
DIRECTOR

R SRINIVASAN  
SECRETARY CUM SR ADMIN OFFICER

**SCHEDULE - F**

PRE YEAR	REPAIRS AND MAINTENANCE [ 23-24 ]	(Amt. in ₹)
1969849	Township	1669776
28800	Electrical Works	172402
155910	Office building /Technical complex	2790552
158658	Rep & Maint Office Vehicles	73936
<b>23,13,217</b>	<b>GRAND TOTAL REPAIR &amp; MAINT</b>	<b>47,06,666</b>

**SCHEDULE - G**

PRE Year	SALARY COMPONENT	(Amt. in ₹)
74730503	Salary and Allowances	79639825
810000	Children Education Allowance (CEA)	783000
11880694	Gratuity Contribution to LIC	13255072
143342	Staff Bonus	151786
2684667	Medical Reimbursement	4307416
7562999	Employer's Contribution to EPF	8104028
8261202	Leave Encashment	2978017
315480	Administrative charges on EPF	337667
45107	Employer's Contribution to EDLI	45726
831779	Group Insurance scheme ( GIS)	568194
1692327	LTC expenses	659265
2274353	Travelling Expenses	1567335
2508888	Salary / wages to Electrical contract staff	2231545
5409991	Salary / wages to Office boys/Peons contract staff	5223144
2503046	Salary / wages to office & Campus Maint contract staff	2165714
7909898	Salary / wages to Security Services contract staff	6124764
0	Salary paid to Consultant (Admin / Stores)	354589
1111880	Salary paid to Consultant (Technical)	594000
290867	Salary paid to Lab Asst. (Contractual)	330000
0	Salary Scientific Asstt-II (Contractual)	1589032
755300	Salary (Administrative IT/Lib.)	0
<b>13,17,22,323</b>	<b>Total Exp</b>	<b>13,10,10,119</b>

## SCHEDULE-H

PRE YEAR	ESTABLISHMENT EXPENSES [ 23-24 ]	(Amt. in ₹ )
115949	Telephone / Fax charges	101724
54888	Internet/ Broadband charges	44592
110784	Office Expenses	117901
6080	Subscription to Periodicals	3740
495718	Legal Expenses	1215100
1000324	Seminars and Conferences - IEC	927870
181547	Staff Canteen / Welfare exp.	151604
7750	Advertisement	64972
57521	Meeting expenses	18250
12151	Computer Stationery/Consumable /Anti-Virus Kit	79515
71737	Republic / Independence day / Foundation day	47353
18061	Hindi Programme exp	30361
1144	Library & Information Expenses	26572
11719	Bank Charges	7604
156250	Professional fees (CA) for ITAX, GST work etc	135500
11800	Tender Cost	0
34923	Recruitment exp	150986
0	Miscll bill receivable from outside party againt adv	133150
<b>23,48,345</b>	<b>TOTAL (Establishment Exp)</b>	<b>32,56,794</b>

<b>46,84,961</b>	<b>UTILITY EXPENSES (Water &amp; Elect)</b>	<b>44,58,952</b>
------------------	---	------------------

<b>70,33,306</b>	<b>GRAND TOTAL (Other Exp) Schedule-H</b>	<b>77,15,746</b>
------------------	---	------------------

Prev Year	Schedule of exp shown in I & E A/c(Schedule-IX)	(Amt. in ₹ )
25000	Audit Expenses	25000
53091	Printing & Stationery	131945
46859	Postage & Courier charges	118384
257005	Fuel and Oils (Vehicle)	258065
80620	Rent, Rates and Taxes	80620
157373	Insurance	120449
<b>6,19,948</b>	<b>TOTAL</b>	<b>7,34,463</b>

**SCHUDULE - I**

PRE YEAR	PROJECT EXPENSES [ 23-24 ]	(Amt. in ₹ )
34200	S-21 Synergstic Utilise of al waste (SSAG)	22086
0	S-22 Devp strip casting Aluminium alloys (SSAG)	56640
0	S-24 Large scale digital database of Bauxite (SSAG)	145770
0	S-25 Nano Processing (SSAG)	65680
0	S-26 Adv Ceramic nanocoatings-automotive (SSAG)	86100
0	S-28 Status report on Red Mud (SSAG)	1277
1299739	S-29 Al scrap recycling survey (SSAG)	0
0	S-30 Fire retardancy of nano-ATH in polymers (SSAG)	234546
1520302	S-31 Bench scale study of Al <sub>2</sub> O <sub>3</sub> extraction CFA (SSAG)	136760
413473	S-32 Bauxite Digestion Efficiency project (SSAG)	0
2077748	S-33 Dross PAC Utilisation Bench Scale (SSAG)	0
3964683	S-34 CRMS for Aluminium Alloys (SSAG)	395928
2808681	S-35 Geo-Tech. Evaluation bauxite & laterite, CG (SSAG)	1147369
1199196	S-36 Solid state recycling of Al chips / waste (SSAG)	3800148
2256328	S-37 Tech for Holistic Utilization of Red Mud (SSAG)	2523176
2024166	S-38 Red mud Valorization-zero waste for X-ray (SSAG)	521471
1852867	S-39 Dev of medium strength alloy (SSAG)	2178547
719722	S-40 Un-diluted Recycling of cast Al Alloys(SSAG)	1573666
1338373	S-41 Production of Onyx grade ATH (SSAG)	2102498
138890	S-42 Fabrication of Al <sub>2</sub> O <sub>3</sub> containing cellulose (SSAG)	954231
832485	S-43 TE survey of COPPER recycling industry (SSAG)	4909077
447507	S-44 TE survey of LEAD recycling industry (SSAG)	5429336
398627	S-45 TE survey of ZINC recycling industry (SSAG)	5017836
0	S-46 Low-cost filler material lithomargic clay (SSAG)	1669399
0	S-47 prototype Al seat frame for passenger bus (SSAG)	3738240
0	S-48 Process- production of high whiteness ATH (SSAG)	1325421
0	S-49 Value-added substance from black dross (SSAG)	409943
0	S & T (MINES) PRISM PROJECT EXP	4800000
198813	N-42 NALCO Utilization of PLK project	0
69832	N-46 NALCO Iron value recovery from Red Mud	0
342535	N-47 NALCO Process for N4 HPA and substrate making	3312294
868551	N-48 NALCO DC Cast Al Alloy for Yoke in Automobile	425116
1911342	N-49 NALCO SPL Project	923256
0	N-50 NALCO Kinetic Study of different Unit operations	356526
0	N-51 NALCO Thermal Balance study- CH furnaces	189201
1761821	P-61 DST Instrument for Real-time measurement of ACD	3982014
5048820	P-62 DST Instrument for onsite AL EL bath parameters	0
181741	P-64 BALCO Instrument for bath measurement	0
0	P-65 M/o Coal : Coal Mine Overburden to Building Matls	1463793
0	P-67 M/o Coal : Coal mine overburden alkali actv comp	342449
1104937	MECL Nagpur Testing /Coal testing work exp etc	5486294
167136	DPR / S&T grant CAPEX expenses	5490404
22395	NABL Certification	28100
267152	Nalco Traning Programme	0
0	Azadi ka Amrit Mahutsav (AKAM)	8264047
<b>3,52,72,061</b>	<b>TOTAL</b>	<b>7,35,08,637</b>

**LAB AMC EXP****SCHEDULE - J**

30132	Lab Operational & Consumables / Spares	0
190000	AMC Computers	269241
29150	AMC CCTV Camara	0
<b>2,49,282</b>	<b>TOTAL</b>	<b>2,69,241</b>

<b>SCHEDULE - K</b>		
<b>PRE YEAR</b>	<b>GOVERNMENT GRANTS [ 23-24 ]</b>	<b>(Amt. in ₹ )</b>
0	GOVT REVENUE GRANT FROM AMDF	3554000
0	GOVT REVENUE GRANT FROM ARA	20000000
76000000	GOVT SALARY GRANT	44500000
<b>76000000</b>	<b>Sub Total - 1</b>	<b>68054000</b>
<b>Ministry of Mines Govt. Grants for Science &amp; Technology Projects</b>		
32694	S-21 Synergistic Utilise of al waste (SSAG)	21306
0	S-22 Devp strip casting Aluminium alloys (SSAG)	50000
0	S-24 Large scale digital database of Bauxite (SSAG)	144117
0	S-25 Nano Processing (SSAG)	63567
0	S-26 Adv Ceramic nanocoatings-automotive (SSAG)	84667
0	S-28 Status report on Red Mud(SSAG)	1109
535500	S-29 Al scrap recycling survey (SSAG)	0
0	S-30 Fire retardancy of nano-ATH in polymers (SSAG)	158300
1151000	S-31 Bench scale study of Al <sub>3</sub> extraction CFA (SSAG)	128600
411000	S-32 Bauxite Digestion Efficiency project (SSAG)	0
2214000	S-33 Dross PAC Utilisation Bench Scale (SSAG)	0
3529000	S-34 CRMS for Aluminium Alloys (SSAG)	393000
0	S-35 Geo-Tech. Eva. bauxite & laterite, CG (SSAG)	1592000
0	S-36 Solid state recycling of Al chips / waste (SSAG)	1137700
0	S-37 Tech for Holistic Utilization of Red Mud (SSAG)	603750
356563	S-38 Red mud Valorization-zero waste for X-ray (SSAG)	708000
3198500	S-39 Dev of medium strength alloy (SSAG)	0
1843750	S-40 Un-diluted Recycling of cast Al Alloys(SSAG)	1181200
2970900	S-41 Production of Onyx grade ATH (SSAG)	0
655725	S-42 Fabrication of Al <sub>2</sub> O <sub>3</sub> containing cellulose (SSAG)	0
5159700	S-43 TE survey of COPPER recycling industry (SSAG)	0
5254200	S-44 TE survey of LEAD recycling industry (SSAG)	0
4868640	S-45 TE survey of ZINC recycling industry (SSAG)	0
2690500	S-46 Low-cost filler material lithomargic clay (SSAG)	0
3655000	S-47 prototype Al seat frame for passenger bus (SSAG)	0
0	S-48 Production of high whiteness ATH (SSAG)	2000000
0	S-49 Value-added substance from black dross (SSAG)	787000
1000000	Govt Grant IEC for Seminar	900000
0	Prism S & T Start-up Project grant	23912000
<b>3,95,26,672</b>	<b>Sub Total – 2</b>	<b>3,38,66,316</b>
<b>11,55,26,672</b>	<b>Grand Total Grants (1+2)</b>	<b>10,19,20,316</b>

## INCOME FROM RESEARCH PROJECTS [ 23-24 ]

		SCHEDULE - L
PRE YEAR	PARTICULARS	(Amt. in ₹ )
	<b>B) Other Research Projects</b>	
2570400	N-46 NALCO Iron value recovery from Red Mud	0
0	N-47 NALCO Process for N4 HPA and substrate making	4143900
0	N-49 NALCO SPL Project	3608400
0	N-50 NALCO Kinetic Study of different Unit operations	2880000
0	N-51 NALCO Thermal Balance study- CH furnaces	1440000
339000	P-63 VEDANTA : Holistic Utilisation of red mud	0
339000	P-63 HINDALCO : Holistic Utilisation of red mud	0
1038000	P-63 NALCO : Holistic Utilisation of red mud	0
2500000	P-64 BALCO Instrument for bath measurement	0
0	P-66 DAIKI Utilization of alumium dross in synthetic slag	1186411
0	P-68 KIMBERLITE : Evaluation of crystal growth modifier)	875000
0	P-69 Performance evaluation of Dewatering chemicals	154000
<b>67,86,400</b>	<b>TOTAL</b>	<b>1,42,87,711</b>

Miscellaneous Receipts [ 23-24 ]		SCHEDULE-M
PRE YEAR	PARTICULARS	(Amt. in ₹)
190184	Misc.Receipts	132937
91397	Licence fees and water charges	83464
252981	Guest house/ Qtr. rent / charges received	216847
6000	Vendor registration fees	16950
332777	Sale of store materials / unservicable	0
14350	Liquidated damages (LD)	0
0	Prior period income not payable to Sundry debtor	2618969
5500	Application fees	533010
<b>8,93,189</b>	<b>TOTAL (Miscellaneous Receipts)</b>	<b>36,02,177</b>

**Program Receipt : Technical Seminar / Training Program**

		SCHEDULE - N
PRE YEAR	PARTICULARS	(Amt. in ₹)
121122	Seminar ICSOBA	0
200000	Seminar on ICNFM-2022	0
1155000	Nalco staff Training Programme at JNARDDC	0
0	AKAM by NALCO, MSTC & NMDC	8100000
<b>14,76,122</b>	<b>Total (Program Receipts)</b>	<b>81,00,000</b>

# 35 Years

commendable service to the  
Aluminium Industry



Serving the Nation

# Since 1989

## Contact Us

📍 Jawaharlal Nehru Aluminium Research Development & Design Centre,  
Autonomous Body (Ministry of Mines), Government of India,  
Opp. Wadi Police Station, Amravati Road, Wadi, Nagpur-440023

☎ 07104-220701

🌐 [www.jnarddc.gov.in](http://www.jnarddc.gov.in)