MISSION FOR ADVANCEMENT IN HIGH-IMPACT AREAS

JOINT CALL FOR CONSORTIA PROPOSALS

MAHA Critical Raw Materials Research Program

(MAHA CRM-Research Program)

by

ANUSANDHAN NATIONAL RESEARCH FOUNDATION

and

MINISTRY OF MINES

MAHA Critical Raw Materials (CRM) Research Program: Call for Consortia Proposals

1. MAHA PROGRAM DESCRIPTION

1.1 BACKGROUND

- ANRF (Anusandhan National Research Foundation) was established by the ANRF Act 2023 in February 2024. ANRF represents India's pioneering efforts to unleash Indian research and innovation talent to achieve global scientific and technological excellence.

- The Mission for Advancement in High-Impact Areas (MAHA) program has been approved by ANRF, which will support priority-centric, solution-based research in a mission-driven mode, focusing on key areas that align with the nation's primary requirements. It is envisioned to be multidisciplinary, multi-institutional, and multi-investigator projects with industrial partnerships in the most pressing areas of concern. ANRF has identified **"Critical Raw Materials (CRM)"** as a research priority area to include under the MAHA program, which will continue to play an essential role in the nation's progress and economic growth as India embarks on the journey of Viksit Bharat 2047.

- The MAHA CRM Research Program will be launched in collaboration with the Ministry of Mines (MoM). It will be a "limited call" where the Centre of Excellence (COEs), as hubs, recognized by the Ministry of Mines, will be invited to submit proposals in a consortium. The proposals should be structured in a hub-and-spoke model to leverage R&D in critical raw materials and pool the core competencies of each constituent under one umbrella. The spokes can be more open, but hubs are limited.

1.2 AIM OF THE MAHA PROGRAM

The MAHA CRM Research Program aims to seed, foster, and nurture scientific and Industrial R&D to create and demonstrate a vibrant, innovative, and agile ecosystem in Critical Raw Materials (CRM) Research in India, driving fundamental understanding and supporting specific technological advances. ANRF will focus on the mission mode outcomes, quality, and impact. The CRM Research Program will help channel substantial funding for R&D through ANRF, utilizing a hub-and-spoke model, where nine COEs, recognized by the Ministry of Mines, should submit their research proposals.

1.3. OBJECTIVES:

- The research program includes augmenting domestic critical mineral capacity, technological advancements, and supporting the beneficiation, extraction, processing, and recycling of electronic waste material or extraction of critical minerals from electronic waste.
- The program is to secure India's critical mineral supply chain by ensuring mineral availability from domestic sources and to strengthen the value chain by fostering

innovation, skill development, etc., by supporting nine COEs recognized by the Ministry of Mines.

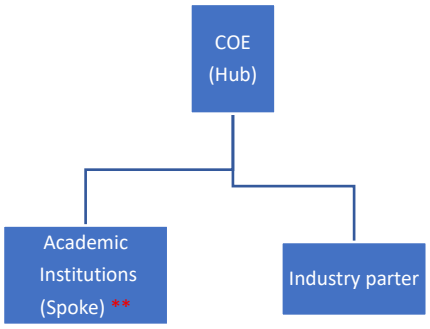
- To increase the critical mass of highly talented researchers in critical minerals in the country, fostering research and education in a similar field
- To build indigenous capacity and intellectual strength required to ensure self-reliance of the nation in the strategic area of critical minerals.

1.4 PROCESS OF SELECTION:

- The Ministry of Mines has recognized nine Centres of Excellence (COEs), and the list of COEs is given below,

1) Indian Institute of Technology (IIT) Bombay
2) Indian Institute of Technology (IIT) Hyderabad
3) Indian Institute of Technology, Indian School of Mines (ISM), Dhanbad
4) Indian Institute of Technology (IIT) Roorkee
5) CSIR – Institute of Minerals & Materials Technology (IMMT), Bhubaneswar
6) CSIR – National Metallurgical Laboratory (NML), Jamshedpur
7) Non-Ferrous Materials Technology Development Center (NFTDC), Hyderabad
8) Indian Institute of Science (IISc), Bangalore
9) Centre of Materials for Electronics and Technology (CMET), Hyderabad

- The MAHA CRM Research Program is to be launched in collaboration with the Ministry of Mines. It will be a "limited call" where nine Centres of Excellence (COEs) as recognized by the Ministry of Mines will be invited to submit proposals in a consortium mode. The proposals should be structured in a Hub (COE) & Spoke (other government/private academic institutions) model to leverage R&D in critical raw materials and pool the core competence of each constituent under one umbrella. The spokes can be more open, but hubs are limited. The following diagram explains the structure of COE.



**Please refer to Section 7 for details. ** **

- The emphasis will be on bridging the "lab-to-market" gap by ensuring that the technology development process is co-owned by academia and industry, thus facilitating faster adoption and commercialization.

- The proposal developed by COE in consortia with industrial partners should include:

(a) A clearly articulated **industry problem statement with a single focus**. It should be different for each COE. Two proposals (maximum) can be submitted by each COE and one of them will be finally chosen by the evaluation committee.
(b) The TRL level (Technology Readiness Level) should be at least **TRL 2** (i.e., the COEs should start work from a level of existing maturity.
(c) The **translation pathway** for converting research outputs into deployable technologies and COE is responsible for the transition.
(d) A **Letter of Intent from the identified industry partner with a credible and compelling plan for translational research**, explicitly mentioning their role, commitment, resources, and interest in co-developing and co-funding (complementary funding) the project proposed by the COE in alignment with the policies of the Ministry of Mines.
(e) Specific deliverables that are **actionable and aligned with national priorities**. There should be major milestones (at least one) for each year. Ongoing funding will be based on the achievement of milestones.
(f) If required, the proposal may include a plan for Pilot Plants for recovery of critical minerals. Proposals for Pilot Plants need to be submitted/uploaded as an additional document with the main proposal with compelling and credible translational plan. The areas for Pilot Plants for Recovery of Critical Minerals from overburden/tailings/fly ash/Red mud, etc. are given in **Annexure-I** which will be dealt with Ministry of Mines separately. The other areas for Pilot Plants will be dealt with ANRF.

- The fund, to be approved per COE (Hub) with spokes, will be based upon evaluation of the proposal, especially the quality of the plan of translation of the R&D, and the necessary co-investments to support that by the industry partner. If this is not satisfactory, those proposals may be deferred (and may be asked to update their proposal) or will not be supported if weak.

- The selection will be based on the recommendations of the **Mission Technical Program Committee (MTPC)**, which is to be constituted by ANRF. If required, the Director/ Head of The Centre (HoC) of COE/Principal Investigator (PI) of the R&D project may be called for discussion/ presentation.

2. ANNOUNCEMENT

Under the CRM Research Program, COEs (identified by the Ministry of Mines) are invited to submit innovative proposals in a consortium mode aligned with the Mission's objectives. The Principal Investigator (PI)/Director of the COEs will, together, be responsible for setting up the CRMRG with a Hub (COE) & Spoke (other government/private academic institutions) structure under the guidance of **the Mission Technical Program Committee (MTPC).** The proposals should demonstrate interdisciplinary CRM Research to propel technological applications and transfer, indigenous contributions, and impactful outcomes, as well as address fundamental issues of Critical Minerals in the priority areas mentioned in **Annexure-II.**

3. FOCUS AREAS OF RESEARCH IN MAHA CRM RESEARCH PROGRAM

The following are the focus areas of R&D in critical raw materials, where we write proposals for technology development and frontier technology's role in mining, extraction, recycling, and processing value chains:

i. Focused R&D to reach higher Technology Readiness Levels of TRL **6+** in CRM;
ii. Non-destructive technologies for Critical Mineral Exploration and AI-based exploration Data Processing
iii. Critical Mineral Potential Assessment, Resource Estimation, and Multi-Metal Recovery from Mine Waste and Surrounding Host Rocks.
iv. Beneficiation, process technologies to extract critical raw materials from any feedstock, and recycling.
v. Combining the generic processes that are required to process any feedstock that contains critical raw materials and dovetailing it to specific feedstock.
vi. Reduced metals and specialty chemicals that aid in beneficiation and separation processes;
vii. Manufacturing of chemicals used in beneficiation and extraction (solvent extraction and ion exchange);
viii. Process equipment design, development, and fabrication;
ix. Encourage and engage researchers in the domain of extractive metallurgy;
x. AI/ ML tools; AI-ML tools can be used to accelerate the CRM research in order to achieve the proposed goal.
xi. Development of CRM-lean/free Technologies for clean energy transition and productization of CRM and CRM-lean fine powders
xii. A pilot-to-national scale project replicating the Heavy Mineral Map of India (HMMI) methodology using sediment sampling, automated mineralogy, and detrital geochronology, with Earth Bank integration.
xiii. Advanced extraction technologies, including biominerallurgy, plasma smelting, vacuum-based refining routes for pure-metal production, and pyro-electrometallurgical processes.
xiv. Process technologies for extraction and recovery of critical raw materials through magnet to magnet.
xv. Development of IMINE™, an integrated process-design software platform featuring a comprehensive process, critical mineral library and AI/ML-driven flowsheet generation and plant-design modules.
xvi. Valorisation of process wastes generated from critical mineral extraction to improve overall process economics and reduce environmental impacts.
xvii. Development of gap unit operations for separation/ purification/conversion of critical elements for preparation of CRM supply chain-oriented products
xviii. Next-generation effluent treatment systems integrating multiple pathways (including bio-sorption) and development of specialty chemicals to support advanced separation processes.
xix. Extraction, refining and ultrahigh purification of CRM to meet the requirement of Indian manufacturing industries, semiconductor industries and strategic sector
xx. Process technologies to extract critical raw materials from e-waste recycling with focus on platinum group metals, Battery pack recycling with efficiency greater than 95% and energy efficient PV recycling

xxi. Recovery of rare earth and other critical metals from steel plant secondary resources, including blast-furnace slag, steel slag, slimes, sludges, and dust, through resource-efficient and environmentally responsible processing routes.

xxii. Recycling and valorisation of electronic waste, with emphasis on printed circuit boards, lithium-ion batteries, permanent magnets, LCD screens, and solar panels.

xxiii. Any other related area with justifications

4. PERFORMANCE PARAMETERS & FUNDING OF R&D PROJETS

The requirement for funds to undertake R&D in critical raw materials shall be met through the Anusandhan National Research Foundation (ANRF). The funding pattern for the approved project proposals under the Programme shall be as follows:

i. The financial support under the Program would include laboratory equipment, plant/ machinery, chemicals, support to research staff (JRF, SRF, RA) until the project period, research literature, and consumables, as well as the filing of patents.

ii. ANRF will assign funding directly to the Hub institute (COE will be operated as a Hub), and the Hub will subsequently disburse funds to the constituent Spokes within the consortium based on their level of participation.

iii. The Hub (COE) is responsible for disbursing funds to Spokes and ensuring their compliance with reporting, milestone achievement, and audit requirements.

iv. Total MAHA Program Outlay:

- **210 Cr for 3 years** for **9 Centres of Excellence (COE) from ANRF**

v. Industry Partners: Mandatory **10% (minimum) in-cash** cost-sharing contribution of the total budget (including pilot plant) alongside a credible plan for translational research. Beyond this, any other source is welcome. Higher level of cash or in kind contribution will be considered positively.

vi. The average outlay for proposal (without pilot plant) is expected to be **20 Cr** with a maximum outlay of **30 Cr**.

vii. The average outlay for Pilot Plant should be **10 Cr** with a maximum outlay of **15 Cr**.

viii. The exact amount of funding given to Hub and Spoke will be recommended by **the Mission Technical Program Committee (MTPC)** and approved by the **ANRF**.

ix. The duration of the R&D project will be up to **3 years**.

x. The funds will be released in three instalments (at least). The first instalment (including capital) will be released after approval of the R&D project. The second and third instalments will be released upon receipt of a satisfactory achievement-cum-performance report, acceptance of the Utilization Certificate, and approval by the competent authority of ANRF. The number of instalments may be changed on a case-by-case basis.

xi. Major milestones (at least one) for each year should be proposed by the PI/ COE HoC /Director of COE. Ongoing funding will depend on achieving milestones.

5. MODE OF SUBMISSION OF PROPOSAL:

- The Call for applications will be notified through the online portal of ANRF "www.anrfonline.in".
- The proposals under the CRM mission should be submitted in online mode only through the website "www.anrfonline.in".
- Proposals submitted in any mode or platform other than the designated one will not be considered by ANRF

7. ELIGIBILITY CRITERIA AND OTHER DETAILS

A detailed outline of the eligibility criteria for the consortia members of CRM Research Group is given below:

i. Consortia-based proposals submitted by the recognized Centres of Excellence (COEs) identified by the Ministry of Mines under the National Critical Mineral Mission (NCMM), related to CRM.

Two proposals (maximum) can be submitted by each COE and one of them will be finally chosen by the evaluation committee.

ii. The recognized COE will be operated as a consortium, on a hub-and-spoke model, to leverage R&D in critical raw materials and pool the core competence of each constituent under one umbrella.

iii. In the consortium, the COE becomes the Hub, and other entities from research & academia (institutes/ universities) become the Spokes. The Hub Institute will be recognized as the COE.

iv. The recognized COE will submit consortia-based proposals involving at **least two industry partners and at least two R&D or academic partners (Spokes)** working in the field of critical minerals and related areas, such as materials science, geology, mining, and metallurgy.

v. Applicants [Principal Investigator (PI)/ COE HoC/Director of COE for Hub and Co-Principal Investigator(s) (Co-PI(s)) for Spoke] should be Indian citizens. Foreign nationals (including OCI and NRI) are also eligible to apply, provided they fulfil the eligibility criteria of ANRF.

vi. The applicant(s) must hold a regular academic/research position in a recognized educational institution/national laboratory/ any other recognized R&D institution in India with a proven track record in the relevant domain.

vii. Government Academic Institutions (Central Universities, State Universities, IITs, IISERs, National Labs, etc) can be the spoke.

viii. Private Academic institutions with valid UGC/AICTE/PCI approval, Private R&D institutions

with valid DSIR-SIRO recognition, and voluntary and Non-governmental organizations registered under the NITI-AAYOG Darpan portal are eligible to be the Spoke.

ix. PI/Co-PI should have at least **3 years** of service remaining at the time of submission of the proposal.

x. ANRF may suggest restructuring the proposals and reorganizing the consortium members based on the nature of the work area, merits, and technology requirements. Accordingly, it may request revised project proposals from COEs.

xi. Proposals submitted must be original in ideation and content. Applications are requested to pre-check their proposals for plagiarism before uploading. Plagiarism in any form will not be acceptable. All submitted proposals will be subjected to a third-party similarity check, and proposals may be rejected if they are found to be plagiarized. Any text taken verbatim from another source needs to be identified using quotation marks and a proper reference.

xii. The COE should possess the necessary infrastructure, laboratories, equipment, and resources to support CRM research, experimentation, and collaboration within the given area.

8. TERMS & CONDITIONS:

8.1 Implementation of the project:

i. Approval of the research proposal and the grant release are contingent upon the specific project being sanctioned and should be exclusively spent on project-related activities within the stipulated timeframe. The COE (Institute/University) may seek funds or in-kind support from relevant industries (Government, Semi-Government, Autonomous, and Private) for this research project, keeping the ANRF informed about the same.

ii. The Institute (COE)/ Principal Investigator (PI)/ Co-PI will furnish a Progress Report of the work on the project after attaining the following benchmark in the first 6 (six) months of project implementation:

a) Appointment of manpower, providing date of appointment & qualifications.
b) Status regarding acquisition of assets sanctioned under the project.
c) Status regarding procurement of sanctioned equipment under the capital head.

iii. The Institute (COE) will not entrust the implementation of the work for which the grant is being sanctioned to another institution, nor will it divert the grant receipts to another Institute as assistance. If the Institute is unable to implement or complete the project, it shall refund to ANRF the entire grant received or the balance of the grant, with interest.

iv. All the personnel, including Research personnel appointed under the project, for the full/ part duration of the project, are to be treated as *temporary employees* and will be governed by the administrative rules/ service conditions (for leave, TA/DA, etc) of the implementing Institute. They are not to be treated as employees of the ANRF or the Government of India, nor as permanent employees of the Institute. *The ANRF will have no liability whatsoever for the project staff after the project duration* is completed.

v. For the expeditious implementation of the research project, the PI will seek the assistance of the Institute in the process of selecting and appointing sanctioned research personnel/staff, as well as in making payments to them. Scale and emoluments for posts not covered under

the ANRF order are governed by the norms prevalent in the implementing Institution or as decided in consultation with ANRF.

vi. The project becomes operative on the date the Electronic Transfer is received by the implementing Institution (COE).

vii. If the results of research are to be legally protected, they should not be published without action being taken to secure legal protection for the research findings.

viii. Any Intellectual Property (IP) generated under the program shall be governed by a joint IP policy developed between ANRF, Ministry of Mines, and the concerned COE, ensuring fair benefit sharing between academia and industry partners

8.2 Utilization of the Funds:

i. The host institute (COE) and the Principal Investigator (PI) must ensure that the funds are used exclusively for the approved research project.

ii. The host institute (COE) must maintain separate audited accounts for the project. Funds should be kept in an interest-earning bank account, with any accrued interest reported to the ANRF in the Statement of Expenditure (SE) or Utilization Certificate (UC).

iii. The COE (University/Institute/Organization) will take the responsibilities of submission of all Financial Documents for the disbursement, receiving, and settlement of funds in time as required.

iv. Anusandhan National Research Foundation (ANRF) is implementing the new TSA hybrid model for fund flow in respect of ANRF Schemes (Scheme Code - 4211). The COE (University/ Institute/Organization) should follow the TSA-SOP available at www.anrfonline.in.

v. The fund shall not be utilized for the construction of any building unless a specific provision is made for that purpose by ANRF. The host institute is responsible for providing essential infrastructure (accommodation, space, water, electricity, communication, etc.) for the project.

vi. Any expenditure incurred prior to the issue of the financial sanction and after the expiry of the sanctioned duration of the project will not be admissible.

8.3 Monitoring the Progress of the Project:

i. PIs should submit annual progress reports in their specified format through the ANRF online portal.
ii. In addition to annual reviews, mid-term evaluation may be conducted by the Mission Technical Program Committee (MTPC) to assess translational progress and technology readiness
iii. ANRF will periodically monitor the project. The PI should attend the Monitoring Meetings/Workshops to present the progress/outcome of the research project, as and when organized.

iv. ANRF may designate a specialist or an Expert Panel to visit the host institute to review the progress of the work being carried out and to suggest suitable measures to ensure the realization of the objectives of the project. During the implementation of the project, the Institute will provide all necessary facilities to visiting scientists, specialists, or the Expert Panel, including accommodation, during their visit.
v. Proposals should outline expected TRL (**Annexure II)** advancement at the end of each year to demonstrate technology maturity.
vi. All projects must comply with applicable environmental, safety, and statutory regulations during implementation

8.4 Release of Next Instalment of Funds:

i. At the end of each financial year (FY) and at the time of seeking further instalment of grant, the Institute/PI has to furnish the following documents strictly as per ANRF formats, and upload the same through the ANRF online portal:
    a. Audited Utilization Certificate (UC), and up-to-date Statement of Expenditure (SE) for the financial year in the correct format.
    b. Annual/interim progress report, as per approved format.
    c. List of publications/patents, if any, from the project.
    d. List of Assets acquired till that Financial Year.
ii. The release of the next installment of the grant will be contingent upon the submission of financial statements and their acceptance by ANRF.

8.5 Transfer, Extension, and Termination of the Project:

i. If the PI/COE HoC/Director wishes to terminate the project, they must inform ANRF immediately, providing proper justification. The host institute (COE) should not incur any expenditure from the date of termination of the project or the date of resignation of the PI, whichever is earlier.

ii. The PI/COE HoC/Director must seek the consent of ANRF if they intend to be away from the implementing Institute (except for field work related to the project) continuously for a period of more than eight weeks after submitting a proper supportive plan, without disturbing the interest/progress of the project.
iii. ANRF reserves the right to terminate the project at any stage if it is convinced that (i) appropriate progress is not being made, (ii) the grant has not been utilized properly, or (iii) furnishing of false information or suppression of factual information.

iv. Transfer of the project from one Institution to another is not allowed as the support is institution-specific (COE).

v. The duration of the R&D project will be up to 3 years.

8.6 Settlement of Accounts of the Project:

i. The following documents must be uploaded to the ANRF online portal within three months after the completion of the project duration:

a. Final Consolidated Statement of Expenditure (SE), giving expenditure financial year-wise (FY) from the date of start till the date of completion.
b. Utilization Certificates (FY-wise), matching with Statement of Expenditure figures.
c. Project Completion Report (PCR) with a list of publications and patents filed/granted.

ii. The host institution, with the coordination of the Principal Investigator (PI), is primarily responsible for the timely submission of utilization certificates, statements of expenditure, progress/monitoring reports, the project closure report (PCR), and the refund of any unspent balance at the end or in the event of early closure of the project. If, due to unforeseen circumstances, the PI is unable to settle the project's accounts, the host institution must submit the above documents to ANRF for the proper closure and settlement of the project's accounts.

8.7 Maintenance of Assets Procured Under the Project:

i. The host institute (COE) must maintain an audited register of permanent or semi-permanent assets acquired primarily with capital funds, including immovable property and movable capital assets listed in the sanction order. The Institute may be required to send a list of these assets to the ANRF.

ii. Assets acquired with project funds are considered part of the Institutional Inventory, gifted by the ANRF. They cannot be disposed of or encumbered without prior approval from ANRF. ANRF has the discretion to allow other investigators to utilize the assets for projects sanctioned by ANRF or advise the host institute to transfer them to any other institute if deemed appropriate.

iii. The Comptroller & Auditor General of India (CAG), at its discretion, shall have the right of access to the books and accounts of the Institute maintained in respect of the fund received from the ANRF.

8.8 Guidelines for Online Application Submission

For successful online submission of the application, the following points may be noted:

a) PI and Co-PI(s) should first register on the official website, click here to register.

b) After logging in, applicant(s) are required to fill all the mandatory fields in the Profile Detail section.

c) Some of the key elements of the proposal should be defined clearly, such as Project Title (max 500 characters), Project summary (max 3000 characters), Keywords (max 6), Objectives of the project (max 1500 characters), Target values being set for the project, Expected output and outcome of the proposal (max 1500 characters)

d) Other Technical Details (OTD) of the proposal must be uploaded as a single file in PDF format.

Annexure-I

Area for Pilot Projects for Recovery of Critical Minerals from overburden/tailings/fly ash/Red mud etc. from Ministry of Mines

The National Mineral Exploration and Development Trust (NMEDT) of the Ministry of Mines has a provision of ₹100 crore for undertaking Pilot Projects for the Recovery of Critical Minerals from overburden/tailings/fly ash/Red mud etc. The areas covered for funding under this initiative are enumerated below:

i. Promoting recovery of critical minerals from mine tailings, dumps, etc.
ii. To encourage optimum recovery of critical minerals from secondary sources.
iii. To develop & commercialize innovative technologies for mineral recovery, and
iv. Promoting technologies such as hydrometallurgy, solvent extraction, electrochemical bio-hydrometallurgy, advanced separation techniques etc. for low grade or complex ore.

Annexure-II

PRIORITY AREAS:

Critical Raw Materials (CRMs) can be grouped into **twenty-one** sets of elements based on their feedstock, allowing for the formulation of a strategy for R&D, including beneficiation and process technologies to extract critical raw materials. These sets are listed in the table below.

Table 1: Grouping of Critical Minerals/Metals based on Sources of Raw Materials for Focused R&D

Set	Target Critical Raw Materials	Critical Raw Materials Sources
PRIMARY SOURCES (ORES AND BENEFICIATION PRODUCTS)		
1	**Co, Mo, Ni, Ti, V, PGE, Li** from Mn-ore	Ferrous ores (Iron, Manganese, Chromite, Vandiferrous, lateritic Ni, etc.)
2	**Cd, Co**, **Ga, Li, In, Mo**, **Ni, Re, REE**, **Se, Te, Ti, V, Zr**	Non-ferrous ores (Base Metal Circuits of Al, Cu, Pb, Zn, Sn) and Zircon and Ilmenite
3	**K, P, REE**	Fertilizer Minerals (Phosphorites, Glauconite, Potash Salt)
4	**REE, V, W**	Graphite ore, Celestite (Sr)
5	**Be, Li, Nb**,	Tn, Columbite/ tantalite, WO3 concentrate, Para tungstate, Tungsten & Gold ores
6	**PGE, Co**, **Ni**	PGE ores
7	**Nb, Ta, REE, Zr**	REE ores
8	**Different critical minerals/ metals**	Other ores except atomic minerals
9	**Co, Mo, Ni, REE, Ti**	Polly-metallic nodules and other offshore minerals
SECONDARY SOURCES		
10	Above critical metals	Mine Rejects/old mine dumps.
11	**Be, Cd**, **Co**, **Ga, In, K, Li, Mo, Ni, Nb**, **P, PGE, Re, REE, Se, Sn**, **Ta, Te, Ti, V, W, Zr**	Beneficiation tailings of base metal, graphite, rock phosphate, etc. (generated by physical separation processes of different ores), and processes residues from an alumina refinery and gold**.**
12	**Cd, Co, Ga, Mo**, **Nb, Ni, Re, `REE, Se, Ta, Te, Ti, V**	Slag (Smelter slag of copper, Lead & Zinc, and tin, slag of iron & steel industry, and Ferro-alloys)
13	**Cd, Co, Ga, Li, Mo, Ni, Re, REE, Se, Te, Ti, V, W, Zr,**	Sludge [Sludge of Cu-Pb-Zn refining, manganese dioxide, etc.]
14	**Cd, Co, In, Mo, Ni,**	Anode slimes formed during the electro-refining of

	PGE, Se, Sn, Te,Ti	metals
15	**Ni, V, PGM, REE**	Flue dusts from pyrometallurgical processes, such as smelters, rotary kilns, and thermal plants.
16	**Co, Ga, Li, Ni, REE, Ti, V,**	Fly Ash/Pond Ash from Power plants
TERTIARY SOURCES		
17	**Co, Mo, Nb, Ni, Ta, V, W/Co, Ni, REE, Ti, Sn**	**Metallic scrap:-** Ferrous metals / Non-ferrous metals and alloys
18	**Li, Cd, Co, Mo, Ni,**	Used Batteries (Ni-Cd, Ni-MH, Li-Ion, Co, Cu, Pb-Acid & graphite batteries)
19	**Ni, PGE, Mo, Ti, V**	Spent Catalysts
20	**Cd, Ga, In, Li, Ni, REE, PGM, Sn, Ta**	electronic waste (e-waste), including EOL solar PV panels
Process supportive technologies		
21	**All**	Reductants (Ca, Na, Mg) are won by electrolysis and Chemicals/additives. Salts of chlorides, fluorides, and sulphates are the starting point.

Each COE may identify its thematic focus from one or more sets listed above, based on existing strengths and regional relevance of mineral resources. However, the main priority areas from Ministry of Mines have been provided below:

Main Priority Areas of Ministry of Mines

Critical minerals are the foundation of contemporary industrial economies, enabling technological advancements and boosting economies. They are defined as a set of naturally occurring elements and compounds that have diverse irreplaceable industrial applications but confront supply-related vulnerabilities either in the form of their limited geographic occurrences or sourcing challenges. With the global shift toward clean energy, the demand for critical minerals is expected to rise substantially to meet the requirements of electric vehicles, wind and solar energy infrastructure, and battery energy storage systems. Minerals such as lithium, nickel, cobalt, and heavy Rare Earth Elements (REEs) are particularly vital for the energy transition and the electric-vehicle battery value chain as well as permanent magnet. Recognizing their strategic importance, these critical minerals have been identified as main priority areas of the Ministry of Mines for ensuring resource security, advancing domestic capabilities, and supporting India's clean-energy and manufacturing ambitions

The explanation for TRL can be found as below,

https://www.dst.defence.gov.au/sites/default/files/basic_pages/documents/TRL%20Explanations_1.pdf