Proposal for Undertaking Geo-chemical Analysis of Mine Samples Through NMET Funding

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April - 2025

1. BACKGROUND

1.1 The Government of India has significantly enhanced its focus on the exploration, mining, and production of critical and strategic minerals that are essential for national development and modern technologies. With the advancement of mining and processing technologies, and depletion of high-grade ores, the cutoff grades have been revised over the years. Materials once deemed subeconomic and discarded as waste—categorized as waste dumps, mineral rejects, sub-grade dumps, and tailing dumps—now offer renewed promise. These dumps, located both at active and abandoned mine sites, could serve as secondary sources of valuable minerals. In this context, historic mine waste dumps and tailings have emerged as valuable targets for secondary resource evaluation, as they may host substantial quantities of critical and strategic elements previously overlooked or unrecovered.

1.2 Historically, mining operations focused primarily on the extraction of the main lease commodities, often ignoring companion or associated elements due to technological or economic limitations. Many of these elements, which were once unrecoverable, are now classified as strategic and critical minerals, crucial for sectors such as electronics, renewable energy, and defence. As a result, legacy extractive wastes, including mine dumps, tailings, and smelter slags, may represent untapped repositories of these high-value materials.

2. PROPOSAL

2.1 Recognizing this potential, Indian Bureau of Mines (IBM) proposes to undertake a study of systematic sampling and geo-chemical analysis of representative samples from mine faces, mineral stacks, dumps, process samples, tailings and smelter slags across the country. The first phase of the exercise will cover copper, lead & zinc, gold, bauxite, chromite, graphite, fluorite, tin, manganese and baryte mines of the country.

2.2 The study will involve collection of samples from mines, processing plants and smelters & their geochemical analysis. The samples from all the mines, processing plants and smelters will be drawn by the officers of IBM.

2.3 Total around 290 number of mines and 50 processing and smelter plants spread across the country are targeted for the study. Total numbers of samples proposed to be collected and analysed will be around 3740. The geochemical analysis is proposed to be taken up for all the radicals as being done for NGCM studies by GSI. This will help in creating a geochemical atlas of the country covering all the mines.

2.4 The Completion timeline for the study is 30th October, 2025. To ensure timely execution of the project, all samples shall be collected by June 2025. Analysis of all the samples including report preparations is proposed to be completed by 31st October 2025.

2.5 IBM has its own in-house facilities for analytical testing at the following places.

1. Modern Mineral Processing Laboratory, Indian Bureau of Mines, Nagpur.
2. Regional Mineral Processing Laboratory, Bangalore.
3. Regional Mineral Processing Laboratory, Ajmer.

2.6 The inhouse testing capacity of the laboratories are limited and the laboratories also cater to various other beneficiation work activities. In view of this, it proposed to engage services of other organizations under the Ministry of Mines and State Government to take up the chemical

analysis of the mine samples through NMET funding. The geochemical analysis will be partly done at the Ore Dressing laboratories of IBM and partly outsourced.

2.7 The proposal is limited to the outsourcing of samples to other laboratories for geochemical analysis. The proposal does not include the cost of sample collection by the officers of IBM and the analysis of samples at IBM laboratories.

2.8 Indian Bureau of Mines (IBM) intends to collaborate with key organizations under the Ministry of Mines and various State Mining Departments for the chemical analysis of samples. The analysis work under NMET funding is proposed to be undertaken through the following institutions:

a) Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDDC), Nagpur
b) Mineral Exploration and Consultancy Limited (MECL), Nagpur
c) Gujarat Mineral Research Development Society (GMRDS), Industries and Mines Department, Commissioner of Mining and Geology, Gujarat.

These organizations, with their technical expertise and advanced analytical infrastructure, will generate reliable geochemical data.

3. TARGET SITES FOR SAMPLING

S.No.	Target Sites	Mine/Processing plants/Smelter	No. of samples to be generated
1	**Mines across India** covering mining leases of copper, lead & zinc, gold, bauxite, chromite, graphite, fluorite, tin and manganese. *(Mine Face, Dump, Mineral Reject, Screen Reject, Tailing Ponds, Tailing dump, Mineral stack)*	290	2900
2	**Processing Plants** including beneficiation plants, refineries, and smelters. *(Feed, Middling, End, Slag)*	50	500
Sub-Total			3400
3	**Check Sampling (10%)**		340
4	**Final number of samples**		3,740

4. PARAMETER FOR ANALYSIS

The following table shows the details of different elements to be analysed for the mine and processing plants samples through different analytical methods following standard operating procedures.

S. No.	Types	Elements	Total Radicals
1	**Major & Trace elements**	Si, Fe, Ca, Mg, Al, Na, Pb, Zn, Mn, Cr, As, S, Ba, LOI	**14**
2	**Critical & Strategic Minerals (Other than REE, PGE)**	Sb, Be, Bi, Cd, Cu, Co, Ga, Ge, Hf, In, Li, Mo, Nb, Ni, Rb, Re, Se, Sr, Ta, Te, Sn, Ti, W, V, Zr, K, P Fixed Carbon in Graphite Sample	**28**
3	**REE**	La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Ho, Er, Dy Tm, Yb, Lu, Sc, Y	**16**
4	**PGE**	Ir, Pt, Pd, Ru, Os, Rh	**6**
5	**Precious Metals**	Au, Ag	**02**
			66

5. QUANTUM OF WORK

Under the proposed work, IBM aims to carry out comprehensive geochemical analysis of mine faces, mineral stacks, mine dumps, tailings, and processing residues to assess their potential for value recovery, especially of critical and strategic minerals.

The total number of samples proposed to be collected from the mines, processing plants & smelters is estimated to be around 3740 samples including check samples. Out of this around 400 samples are proposed to be analysed at in- house facilities available in IBM and rest of the samples shall be outsourced to these agencies for sub sampling and analysis. Therefore tentatively 3340 samples are proposed to be outsourced to various agencies on nomination basis. The commodity wise various radicals proposed to be analysed are as follows:

S.No.	Mines and Processing plants	Major elements	Critical & Strategic Minerals (Other than REE, PGE)	REE	PGE	Precious Metals (Au, Ag)	Fixed Carbon
1	**Bauxite**	✓	✓	✓	✓	✓	
2	**Chromite**	✓	✓	✓	✓	✓	
3	**Copper**	✓	✓	✓	✓		
4	**Fluorite**	✓	✓	✓			
5	**Gold**	✓	✓	✓	✓	✓	
6	**Graphite**	✓	✓	✓			✓
7	**Lead & Zinc**	✓	✓	✓		✓	
8	**Manganese**	✓	✓	✓			
9	**Tin**	✓	✓	✓	✓	✓	
10	**Baryte**	✓	✓	✓	✓	✓	

6. TIME SCHEDULE AND COST ESTIMATES

6.1 The proposed geochemical characterization programme is structured in such a way that all major activities including sample collection from mines, beneficiation plants, and smelters; packaging and dispatch; and laboratory processing such as sample preparation and geochemical analysis (WD-XRF, ICP-MS, GF-AAS, and TOC) will be completed within a period of 6 months i.e. by 31st October 2025.

Scheduled Timelines for Sampling and Analysis									
S. No.	Activities	2025							
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	Collection of Samples from Mines and Plants									
2	Analysis of the Samples									
3	Report preparation									

6.2 The cost of the project involving outside agencies for analysis has been estimated based on actual schedule of rates mandated in the circular OM No. 61/1/2018/NMET dated 31st March 2020 for NMET funded Projects. The total estimated cost is **Rs. 1280.49 Lakhs**. The summary of cost estimates for this programme is given below.

Summary of Cost Estimates

Sl. No.	Item	Total Estimated Cost (Rs.)
1	Geologist mandays sampling and Sample preparations	30,36,352
2	Laboratory studies	10,54,79,940
3	Sub Total (1 to 2)	10,85,16,292
4	GST 18%	1,95,32,932.56
	Total:	**12,80,49,224.6**
	Say Rs. In Lakh	**1280.49**

Enclosure: Detailed Cost Sheet

ESTIMATED COST for Undertaking Chemical Analysis of Mine Samples							
Sl. No.	**Item of Work**	**Unit**	**Rates as per NMET SoC 2020-21**		**Total Cost of the Project**		**Remarks**
			SoC-Item- S. No.	**Rates as per SoC**	**Qty./days**	**Total Amount (Rs.)**	
1.0	**Other Geological Work /Activities and Miscellaneous Charges**						
1.1	Sampling man days - Sampler (core sample,) Labour charge not included	day	1.5.2	5,100	418	21,31,800	3340 (total samples)/8 (no. of samples processed each day)
1.2	4 labours/ sampler (Rs 541/day/labour) (As per rates of Central Labour Commissioner) for sampling work	day	5.7	541	1672	9,04,552	Amount will be reimburse as per the notified rates by the Central Labour Commissioner or respective State Govt. whichever is higher
Sub-Total 1						**30,36,352**	
2.0	**Laboratory Studies**						
2.1	Estimation of major oxides by XRF technique	per sample	4.1.15a	4,200	3340	1,40,28,000	
2.2	14 REE elements/radicals by ICP-MS	per sample	4.1.13	5,380	3340	1,79,69,200	

2.3	34 trace elements by ICP-AES / ICPMS	per sample	4.1.14	7,731	3340	2,58,21,540	
2.4	Gold by fire assay technique	per sample	4.1.5a	2,380	3340	79,49,200	
2.5	PGE (ICP-MS Ni-S Fire assay technique)	per sample	4.1.5d	11,800	3340	3,94,12,000	
2.6	Fixed Carbon in Graphite for Primary and Check Samples	per sample	4.1.16	3000	100	3,00,000	
Sub-Total 2						10,54,79,940	
Total Estimated Cost without GST						**10,85,16,292**	
Provision for GST (18%)						**1,95,32,932.56**	GST will be reimburse as per actual and as per notified prescribed rate
Total Estimated Cost with GST						**12,80,49,224.6**	
Say Rs. in Lakhs						**1280.49**	