## MEMBERS OF SUB GROUP IV

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PRESENTATION PLAN

- INTRODUCTION
- AUTOMATION & MODERNISATION OF MINING SECTOR
- RESEARCH & DEVELOPMENT, TRAINING INCLUDING TECHNOLOGY METALS DEVELOPMENT
- ROLE OF REGULATORY AGENCIES
- EFFECTIVE GOVERNANCE IN MINING SECTOR
- GLOBAL REPORTINGS STANDARDS AND RANKING SYSTEM
- HUMAN RESOURCE DEVELOPMENT IN MINING SECTOR
- KEY RECOMMENDATIONS
Terms of Reference (TOR)

1. To suggest ways of ensuring modernization, automation and computerization of mining sector in the interest of scientific mining, safety and productivity.

2. To review the R&D set up in Mining Sector and to suggest strategy for exploiting and beneficiating low grade ores and adoption of state of art technology to ensure zero waste mining in the country.

3. To review the outcome of R&D and training and suggest ways for capacity building for organizations concerned in the mineral sector and ways of developing centers of excellence in R&D, for both fundamental and multidisciplinary research.

4. To review the role of regulatory agencies namely Indian Bureau of Mines and the State Directorates of Geology and Mining and suggest measures for strengthening them through capacity building measures.
5. To suggest ways for making the governance system more effective in the mining sector, mechanism of prevention and detection of illegal mining across States and possible ways to develop capacities of concerned organizations for detecting, preventing illegal mining.

6. To develop global reporting standards and ranking systems for mining companies in mining practices.

7. To create institutional mechanism for funding information, Education and Communications initiatives, including content development. To review the availability and requirement of human resource in mining sector during the XII Plan period and to suggest measures for capacity building by training and development of infrastructure for technical education and skill development.

8. To make such other recommendations as may be considered appropriate.
CHAPTER – I

INTRODUCTION
INTRODUCTION

• India is endowed with very rich mineral resources and skilled manpower, it is important that scientific and detailed exploration is done for minerals using state of the art techniques in geologically conducive mineral bearing area which may lead to the growth and development of the mining sector in India.

• India continues to lack in several critical minerals like diamond, nickel, copper, gold, platinum group of elements, tin, tungsten, molybdenum, fertilizer minerals etc. The situation therefore calls for immediate attention and efforts to augment their resources.

• Government of India has permitted 100% FDI in mineral exploration, mining and mineral processing, which has some what led to narrowing of technology gaps and exposed the Indian mineral industry to the foreign technology and practices.
INTRODUCTION

• NMP-2008 was formulated with a specific objective to deal with extraction of mineral resources delineated by regional and detailed exploration in a scientific and systematic manner over the entire geologically conducive mineral bearing areas of the country in a time bound manner.

• Specific thrust is being given on scientific methods of mining, beneficiation and economic utilization with upgraded mining technology for utilization of entire run-of mines with renewed R&D efforts. The zero waste mining will be the national goal.

• During the midterm appraisal of the XI Five Year Plan, following were the areas of concern:
  - Illegal mining is rampant in many states. Strong action is required by the states to check such illegal activities.
  - There is shortage of geo-scientists in the mineral sector due to less intake in the past in GSI and IBM and poor career progression. Steps need to be taken for enhancing the capabilities to ensure faster growth in the sector.
  - There is a need to improve management capacity at central and State Government levels.
INTRODUCTION

- No visible impact/outcome has been observed in R & D sector inspite of sufficient investment.
- A greater emphasis will have to be laid on research & development for exploration and exploitation of deep-seated mineral deposits adopting concept oriented programmes and application of cost effective and environment friendly mining technology.
- There is need to re-engineer the national human asset in order to enhance their level of performance.
- There is a need to look at fundamental issues governing R&D and human resource development for the mineral sector ranging from revision of course curricula in line with modern developments, continuing education and training, interdisciplinary R&D in thrust areas, knowledge integration paradigms and national mission programmes to meet the ambitious growth plans for the mineral industry.
INTRODUCTION

• Ministry of Mines has moved forward to develop a Sustainable Development Framework for the country's mining sector to ensure that mining operations are undertaken keeping in view the interest of stakeholders including the host population and the environment.

• In order to strengthen the growth of mineral sector and mining industry due emphasis needs to be given on the policy measures for ensuring modernization, automation, etc. for scientific mining, developments and renewed efforts in R&D, strengthening of regulatory agencies along with trained professionals for the industry while formulating the document for XII Plan.
AUTOMATION & MODERNISATION

- Scientific methods of Mining
- Mining Technology
- Automation and Modernization in Mining
- Mine Safety and Productivity
AUTOMATION & MODERNISATION

• SCIENTIFIC METHODS OF MINING

➢ As per National Mineral Policy – 2008, the extraction of mineral resources located through exploration & prospecting has to be maximized through scientific methods of mining, beneficiation & economic utilization.

➢ Mining technology needs to be upgraded through modernization, automation, computerization to ensure extraction & utilization of the entire Run of Mine (ROM) taking care of all safety measures.

➢ A co-ordinated efforts between R & D institutions, the entrepreneurs, mining machinery manufactures and statutory bodies is need of the hour to achieve the zero waste mining - the national goal.

➢ A framework of sustainable development to be designed which take care of bio-diversity issues and to ensure that mining activity take place along with suitable measures for restoration of the ecological balance with due emphasis to hoist population.
AUTOMATION & MODERNISATION

- Mine development and mineral conservation as governed by the rules and regulations would be on sound scientific basis with regulatory agencies viz Indian Bureau of Mines and State Directorates, closely interacting with R & D organizations / institutions and scientific & professional bodies to ensure optimal mining plans.
- The regulatory agencies should be suitably strengthened through capacity building measures.
- Research and Development thrust would be directed specially in the area of rock mechanics, ground control, mine design engineering, equipment development & maintenance, energy conservation, environmental protection, safety operation and human engineering.
AUTOMATION & MODERNISATION

MINING TECHNOLOGY

- The mining technology adopted should be sustainable to meet the output levels commensurate with environmental protection, safety, health, conservation and economics. The ultimate goal should be to develop technology for cent per cent extraction and utilization of mineral deposits.

- To achieve the goal of Zero Waste Mining, the following points are suggested:
  - The low grade minerals and the less important minerals along with the main minerals which can not be extracted economically today should be stacked in a systematic manner so that it could be used for mineral extraction at later date when these become economically viable.
  - Efforts should be made to mine as far as possible only the desired ore. In case of waste bands in the ore body, the same may be sorted out after blasting and be disposed off in the stope itself.
  - An extensive R&D effort is needed to use the slime part of waste/tailing for some industrial purposes.
AUTOMATION & MODERNISATION

- If there are number of thin parallel lenses which can not individually be mined economically could be merged to make a thick ore body which could then be mined economically by a suitable mechanized method.

- **Recommendations:**
  - **Major Thrust Area in Mining:**
    - Application of advanced technology tools like computerized management plan, MIS, total quality management, remote sensing, etc should be intensified to make mining more efficient and sustainable.
    - Environmental protection and land reclamation is major challenge for mines and allied industries. Sustainable technology suitable for environmentally fragile areas needs also to be developed.
    - Safer mining practices are to be developed to eliminate accidents and disasters caused due to ground movement, mine fires, explosions, inundation and equipment usage.
    - Suitable steps are to be taken to guard the health of miners from occupational diseases and improve the comfort conditions of underground face workers.
AUTOMATION & MODERNIZATION

- Large scale mechanization coupled with heavy equipment to improve productivity, which calls for more emphasis on maintenance.
- Development of methodologies and techniques for processing low grade ores.
- Infrastructure development to support mining and mining areas.
- Mine Planning and Design.
- Ground Control & Rock Mechanics.
- Rock – Water interactions.
- Deep Shaft Sinking, Winding and Transport.
- Mining Machinery optimization and Mechanized mining.
- Studies for in-situ leaching in mines.
- Studies for deep mine environment.
- Development of sensors and Mine Safety.
- Technology of deep mining.
- Latest technology for deeper mine survey
- Closure of mine
AUTOMATION & MODERNISATION

Mining Equipments and machinery

• In order to improve the competitive edge of the Mining Industry, emphasis should be laid on mechanization to improve the efficiency, productivity and economics of mining operations and safety & health of persons working in mines.
• Import of mining equipments and machineries for mechanization of mining sector should be freely allowed.
• Some of the modern equipment that can be used for mining are:
  • Shaft boring machines for deep shaft sinking
  • Faster mine development raise borer
  • Faster mine development tunnel borer
  • Jumbo Drill Machine, LHD & LPDT
• A consortium of Private/Public Sector companies should be set up for buying and owning the high cost machines like shaft/raise borers and tunneling machines and hiring / leasing of these machines to all the mining companies for its optimum utilization.
AUTOMATION & MODERNISATION

Automation in Mining

- Automation in Mining to be done by means of intelligent, fully automated machine robots, equipped with sensors and control programme, making possible the autonomous work with full recognition of the internal state & external environment, analysis of the production process, automatic control, data processing, modeling & simulation, virtual reality, control of technological process safety control, etc.

Computerization of Mining Industry

- Our endeavor should be to induct the latest technologies of Information Technology in Mining Industry and to tap the maximum potential of our employees in mineral industry by continuously upgrading their knowledge & skill.
- Some of main thrust areas for using Information Technology in Mining Sector:
  - Image processing, virtual mining, solid Modeling & Visualization.
  - Computer applications in Mine Design & Planning.
AUTOMATION & MODERNISATION

- Improving production and productivity.
- Loading, Transport and Dispatch system.
- Maintenance Management of equipments.
- Techniques for optimization of Blast Design.
- Updating of Open Cast Mine faces and resource Modeling using advanced Hardware & Software.
- Development of programme for Deep Mine Hoisting System.
- Reorganization of Ventilation Network in underground mines through computer simulation.
- Preparation of Mine Plans and Sections using Auto CAD/Map.
- Management for Mine Safety, HRD & Training
AUTOMATION & MODERNISATION

Mine safety and productivity

• Efforts must be directed towards the development and adoption of mining methods which would increase the safety of workers and reduce the accidents.
• Problems of rockburst, ground control in high stress field, problems of heat and humidity, hauling from long distances and winding from greater depth will need to be addressed.
• The enforcement of Safety Rules & Regulations in mines, Regulatory Bodies i.e. Directorate General of Mines Safety and National Institute of Miner's Health should be strengthened.
• Modern and efficient mining facilities utilize improved control methods and increased mechanization & automation and computerization during mining process will increase safety and production efficiency.
• Safety and Productivity are not mutually exclusive but can go together hand in hand.
R&D AND TRAINING

- Preamble
- Present Indigenous R&D set up in Mining Sector
- Research and Development in Mining Technology for achieving zero waste mining.
- Strategy for State-of-art technology in mining and beneficiation of low grade ores.
- Capacity building of mining organizations.
- Developing centres of excellence in R&D for fundamental and multidisciplinary research.
R&D AND TRAINING

PREAMBLE

- Development of mineral sector includes processes of exploration, mining, value addition, transportation, using, reusing, recycling and disposal of minerals & metal products in most efficient, competitive and environmentally responsible manner using best international practices. Therefore, in order to ensure sustainable development of mineral sector, it is necessary to strengthen infrastructure for Research & Development and training of human resources.

- In the National Mineral Policy- 2008, it is envisaged that, Research and Development in the mineral sector has to cover the entire gamut of activities from geological survey, exploration, mining beneficiation, concentration of minerals to development of materials.

- To achieve the above perspective, emphasis has been given to Research in Mining Methods, Mineral processing and Beneficiation, Development of Automated Equipment, Off Shore Mining, Production of Materials of High Purity and Coordination of Research organizations.
R&D AND TRAINING

Present R & D set up in mining sector

• In spite of a large network of indigenous R & D set up in mineral/mining sector with strong technical capabilities and facilities in the country, the following are the main areas of concern which are to be addressed in result oriented manner.

• Coordination between the industry, R & D institutions and the academia and set up of an umbrella agency for directing the efforts of the institutions towards commercialization.

• Networking with national and international institutions.

• Utilization of advanced equipments/installations and facilities at R & D institutions, Industries and universities.

• Collaborative approach for marketing R & D operations as unified national programme.

• Funding of the R & D projects by the Private sector/user industries.

• Utilization of funds earmarked by Government for R & D activities and training under the previous five year plans.
R&D AND TRAINING

R&D for ZERO WASTE MINING

• In the NMP 2008 it is emphasized that Zero waste mining will be the national goal and mining technology will be upgraded to ensure extraction and utilization of the entire run-of-mines.

• Mining enterprise/organization to prepare a mine waste management plan for reuse of mining wastes wherever possible and feasible to improve the economic viability and to mitigate various associated environmental issues/problems encountered in effective disposal of mining waste.

• Mineral value addition through latest techniques of beneficiation, calibration, blending, sizing, concentration, pelletisation, purification and general customization of product should be encouraged.

• To enable the use of state of the art exploration techniques, scientific mining and optimal use of minerals through ore dressing and beneficiation technologies it is necessary not only to promote research and development in minerals but to simultaneously establish appropriate educational and training facilities for human resources development to meet the manpower requirements of the mineral industry.
R&D AND TRAINING

BENEFICIATION OF LOW GRADE ORES

- In the NMP 2008, it is envisaged that attention will be given to beneficiation and agglomeration techniques to bring lower grades and finer size material into use.
- The strategy for mining and beneficiation of low grade ores as envisaged in XI plan document and recommendations made there-in, are to be reviewed for extent of implementation during the XI plan period so far, and to be reconsidered for XII plan for further implementation.
- Research organizations, including the National Mineral Processing Laboratories of the Indian Bureau of Mines will be strengthened for development of processes for beneficiation and mineral & elemental analysis of ores and ore dressing products.
- Research and development shall be oriented to ensure maximum economic recovery of the associated minerals and valuable metals.
- Establish appropriate educational and training facilities for human resources development to meet the skilled/expert manpower requirements of the mineral industry.
R&D AND TRAINING: CAPACITY BUILDING

Building in house facilities by mining organizations for R & D work and imparting training to its human resources in advanced, state-of-art technology in their respective field of mining operations.

- Research & Development thrust shall be directed specially in the areas of rock mechanics & ground control, mine ventilation & underground environment, mine design engineering, equipment deployment and maintenance, energy conservation, environmental protection, safety of operations and human engineering.

- Considering the shift of mining activities to deeper levels, due to depletion/exhaustion of shallow mineral deposits on account of continuous mining, the thrust in R & D is also essential for tackling problems related to deep mining.

- The mining organizations should make appropriate funding provisions in their growth plan and future investment plan exclusively for R & D and training of human resources.
R&D AND TRAINING

Centres of Excellence in R & D for networked research.

- Considering need to have trained manpower in the field of exploration, geology, geophysics, drilling, mining, mineral processing and metallurgy, there is an immediate need to reorganize and strengthen the infrastructure for training in multidisciplinary fields, and upgradation of the present training infrastructures to an international standard.

- The Centres should be networked and linked to UGC, CSIR, Autonomous and AICTE system for providing degree / diploma. Strengthening of institutions like ISM should also be considered.

- Creation of Centres of excellence is to be first initiated which will require human resource at high level of expertise in R & D in specialized fields and at the same time, knowledge workers in the respective knowledge domains.
R&D AND TRAINING

- Linkages and interaction between the various institutions engaged in R&D in the mineral sector shall be strengthened to derive the maximum benefit.
- Strengthening the coordination & interaction mechanism between the various Science & Technology institutions, R & D Centres, and Entrepreneurs/organisations in the mineral sector to derive the maximum benefit for the mineral industry.
- Basic R & D facilities/supports to be provided/developed in the laboratories under the State Government to benefit the Small & Medium Enterprises (SMEs).
- Private sector in R & D should have fiscal support.
- To undertake the R & D works/projects related to various problems/issues related to Mining including deep mining activity.
- R & D projects are proposed for Exploration, Mining and Mineral Processing & Value Addition by involving R & D set up of GSI, IBM and MECL.
R&D AND TRAINING: KEY RECOMMENDATIONS

A) Exploration:

- Numerical modeling of the crustal processes leading to formation of minerals.
- Study of metallogenesis and distribution of mineral deposits in space and time using computer-simulation/numerical-modeling.
- Study of the metallogenic processes for exploration of the deep-seated and concealed deposits by integrating geophysical geochemical and geological/petro-logical tools.
- Study of the greenstone belts and their associated minerals specially gold and platinum group elements mineralization.
- Study of the Precambrian granites and porphyries and related hypogene mineralization of tin, tungsten and copper.
- Study of the geochemistry of Paleo-weathering sites and such other locales of mineralization for gold, uranium and nickel.
- Study of beach sand and placer deposits, and the concealed mineral deposits in the continental shelf within the EEZ.
- PGE mineralization in layered igneous complexes and other bodies.
B) Mining:
The thrust areas for R & D in deep mining would include:

- Mine planning and design including use of modern technology for excavation of deep shafts for approaching the deep-seated deposits.
- Applied rock mechanics and ground control.
- Underground environment.
- Hoisting from deep horizons.
- Alternative methods of extraction such as in-situ leaching/bio-leaching/solution-mining.
- Application of modern electronics communication system for improving safety of operations in deep mining.
- Application of modern technology with high degree of mechanisation for large production would enable mining of even little lower grade minerals without jeopardizing the economics.
- The closed / abandoned mines for the metallic minerals viz, Gold, Silver, Copper, Lead & Zinc, etc, due to non-viability for exploitation to be revived with implementation by adopting new mining technology and benification techniques.
R&D AND TRAINING: KEY RECOMMENDATIONS

C) Mineral Processing and Value Addition:

The major thrust areas for R & D in mineral processing would include the following:

- Development of newer cost effective technologies for up-gradation of low grade ores.
- Extraction of by-products and research into the use of remaining products, that is, the so called waste today, to effect zero waste mining. This will also include effective waste management and extraction of the valuable contents from slag, tailings, old waste dumps, anode mud and other slimes.
- Extensive application of mathematical modeling and computer simulation in mineral processing.
- Development of value added products for all minerals with value addition at all levels of minerals processing.
- Development of multi-material extraction process and technology for beach sands.
- Application of advanced research for production of material of high purity.
D) An end to end technology development with systems approach and deployment paradigm in a consortium mode with dedicated mission projects is necessary as a strategy for the following Strategically Important Minerals and Technology Metals.

1. Minor metals produced as by-products of base metals (Mo, Re, Te, Se, Ge, Cd, In, Ga, V, Sc)

There are nearly 10 important minor metals used in many applications which have impacted our lives in a big way. Their availability is critically linked to production of primary base metals like Cu, Al, Pb/Zn and their extraction in the primary circuit itself. They are used in very small quantities but when multiplied by large volumes of ultimate products, they become strategically important. The applications range from aircraft engines, motors and domestic appliances, automobiles, cell phones and computers, ubiquitous energy devices thus serving a large consumer base.
2. Metals produced from their generic minerals.
   a) Important Transition Metals: Ti, Zr, Ni, Co, V, Cr
      - Beach sands are an important source for rare earths and group IVA metals (Ti, Zr, Hf). Titanium, Zirconium and Hafnium are produced by metallothermic reduction of their chlorides by magnesium metal.
      - Zirconium is entirely in atomic sector and it is augmented primarily for use in fuel clad assemblies.
   b) Refractory Metals: Nb, Ta, W, Mo, V
   c) Minerals and Metals Enabling Energy Technologies
      (Solar grade Si, Li compounds, chalcogenides, Cassiterites)
      While the predominant position of Silicon as an important metal that ushered in the solar energy conversion devices is well known, what is emerging in the past decade and which is going to make big inroads is LITHIUM based compounds.

3. Rare Earths Metals: samarium(Sm), neodymium(Nd), cerium(Ce), lanthanum(La), Gadolinium(Gd), Dysprosium(Dy)
   Important rare earth metals such as samarium(Sm), neodymium(Nd), cerium(Ce), lanthanum(La), Gadolinium(Gd), Dysprosium(Dy) are required to be extracted
4. Primary Metallurgical Reductant Metals:
Magnesium (Mg), Calcium (Ca) and Lanthanum (La)

In addition to carbon and hydrogen which are the workhorse reductants available to a metallurgist, metals such as Na, Al, Si, Mg, Ca and La serve as important metals that reduce oxides, chlorides and fluorides of other important technology metals.
RESEARCH & DEVELOPMENT AND TRAINING

• In order to meet the requirement for R & D development in thrust areas identified for the XII Plan, a National R&D Fund in the form of Grant-in-Aid under the domain of Ministry of Mines is proposed to be created for catering to requirement of above mentioned specific areas.
  a. National Institute for Mineral Development – Rs. 500 crores
  b. Grant-in-Aid for Mineral Exploration – Rs. 50 crores
  c. Grant-in-Aid for Mining – Rs. 50 crores
  d. Grant-in-Aid for Mineral Processing – Rs. 50 crores
  e. PPP Models for private organisations to develop the above kind of centres in their respective domains. This may be 50:50 Model (50% by Government and 50% by Private company)- Rs. 50 crores.
  f. R & D thrust programme for technology metals with a significant outlay (say Rs 250 crores) is required to attend to the entire spectrum of activities, ranging from exploration to mining to beneficiation to extraction to purification together with process equipment developments.
CHAPTER - IV

ROLE OF REGULATORY AGENCIES

- Review of role of Indian Bureau of Mines & State DGM

- Strengthening of state regulatory agencies by use of modern technology and informatics
ROLE OF REGULATORY AGENCIES

- Role of Indian Bureau of Mines and State Directorates of Geology and Mining

- Since Indian Bureau of Mines and State Directorates of Mining & Geology are responsible for regulations at each step, a comprehensive framework has to be formulated for the most sustainable use of the country’s mineral resources for national development, taking due notice of the conflicts of interests of various agencies.

- Therefore Indian Bureau of Mines and State Directorates of Mining & Geology to be strengthened with manpower, equipment, and skill sets upgraded to the level of state of the art.
**ROLE OF REGULATORY AGENCIES**

- **The New Charter of Functions of Indian Bureau of Mines:**
  - To promote systematic and scientific development of mineral resources of the country (both onshore and offshore)
  - To approve mining plans, schemes and mine closure plans having regard to conservation of minerals and protection of environment.
  - To collect, collate and maintain database on exploration, prospecting, mines and minerals and to bring out publications / bulletins highlighting the problems and prospects of mining industry.
  - To play a pro-active role in minimising adverse impact of mining on environment by undertaking environmental assessment studies on regional basis.
  - To conduct suo moto techno-economic field studies in mining, geology, mineral processing and environmental aspects including analysis of ore and minerals and to promote R & D activities in these areas.
ROLE OF REGULATORY AGENCIES

- To provide training to the scientific, technical and other cadres of the department and persons from the mining industry and other agencies for human resource development.
- To advise the Government on matters in regard to the mineral industry, relating to environment protection and pollution control, export and import policies, trade, mineral legislation, fiscal incentives and related matters.
- To promote awareness about conservation, systematic and scientific development of mineral deposits and protection of environment including restoration and rehabilitation of mined out areas through exhibitions and audiovisual media.
- To promote and monitor community development activities in the mining areas.
- To undertake any such other activity as may become necessary in the light of the developments in the field of geology, mining, mineral beneficiation and environment.
ROLE OF REGULATORY AGENCIES

Organizational Structure of Indian Bureau of Mine

1. Mines Control & Conservation of Minerals (MCCM) Division
2. Ore Dressing (OD) Division
3. Planning and Coordination (P&C) Division
4. Mineral Economics (ME) Division
5. Mining and Mineral Statistics (MMS) Division
6. Mining and Mineral Statistics (MMS) Division
ROLE OF REGULATORY AGENCIES

- Recommendations
- The main thrust areas of Indian Bureau of Mines are:
  - Systematic & Scientific Methods of Mining
  - Sustainable Development of Mineral resources
  - Environmental Protection in Mining Areas

- Strengthening of Indian Bureau of Mines (IBM)

1. A committee has been constituted in the Ministry of Mines for revising and restructuring of functions and role of IBM in terms of the Policy directions given in the National Mineral Policy (NMP), 2008. The committee has prepared a draft report and recommendations of committee may be implemented.

2. Government have approved the revival of 86 scientific and technical posts in IBM, which was abolished earlier.
ROLE OF REGULATORY AGENCIES

- Strengthening of state regulatory agencies by use of modern technology and informatics.

The different ways by which the agencies can be strengthen:

1. Implementation of Uniform Mineral Policy
2. Geoinformatics
3. HR Development and Training
4. Cluster Deposit Mining
5. e-governance
6. Revision of Royalty Rates
7. Scientific and systematic mining
8. Land use planning and Sustainable Development
9. Ore-linkage and value addition
10. Joint Venture with Public Sector
11. Environmental and Forest related issues
ROLE OF REGULATORY AGENCIES

12. Mining in Tribal Areas
13. Development of Infrastructure
14. Reclamation & Restoration
15. Prevention and Control of Illegal Mining Revision of Royalty Rates
ROLE OF REGULATORY AGENCIES

- **Capacity development of State Directorates of Geology and Mining**

  - As per National Mineral Policy-2008, there is a need for the Central and State Government to play a facilitating and regulatory role while encouraging more and more private sector participation in exploration and mining, so as to make it the main source of investment in the sector. Therefore, it is required that GSI, IBM and the State Directorate of Geology & Mining (DGM) be strengthened with manpower, equipment and skill sets for the purpose.

  - Most of the State Directorates of Mining & Geology lack adequate competence and laboratory backup for ore testing and beneficiation studies, for granting approval of Mining plans, checking of illegal/unscientific mining, awareness about sustainable mining practices and GIS based mining tenements and mineral concession database etc. The State Directorates of Mining & Geology need to be strengthened through a management and technology oriented intervention of IBM and GSI.
ROLE OF REGULATORY AGENCIES

- **Capacity development of State Directorates of Geology and Mining**
  - Setting up of laboratories for testing and, ore beneficiation studies.
  - Creation of facilities for large scale (more than 1:50 K) geological, geophysical, geochemical mapping.
  - Creation for competence for the studies of natural hazards and multidisciplinary geosciences including climate change related studies.
  - Setting up of Portals and Websites for geospatial data, mineral resource inventories, tenement data and mineral concession related data and online linking with IBM.
  - Creation of mechanisms to prevent and detect illegal mining. Setting up facility for the study of remotely sensed data for detection of illegal mining and training of the DGM’s officials.
  - Setting up of facilities for EIA and sustainable development studies.
  - Creation of facilities for scrutiny and approval of prospecting and mining plans and mine closure plans.
ROLE OF REGULATORY AGENCIES

- Management of mine closure events.
- Awareness creation regarding sustainable mining.
- Training and human resource development for sector.
- Reclamation of the abandoned mines causing environmental degradation.
- Support for geo-technical and other geo-scientific investigations such as landslide risk assessment, disaster management, natural hazard zonation maps, geo-environmental studies, geo-hydrological studies, remote sensing studies, seismic studies including seismic micro zonation (NER specific).
- Support for organizing promotional events such as conferences / investors meeting Setting of Geological Museums for awareness and Promoting Geo-tourism (NER specific).
EFFECTIVE GOVERNANCE
CHAPTER - V

EFFECTIVE GOVERNANCE IN MINING SECTOR

- Good and Effective governance
- Illegal Mining in India
- How to identify Surface Illegal Mining?
- How to identify Underground illegal Mining?
- Steps taken to curb Illegal Mining.
- Steps taken by the Ministry of Mines / IBM to curb the illegal mining
- Use of Modern Technology to curb Illegal Mining.
**EFFECTIVE GOVERNANCE IN MINING SECTOR**

- Good and Effective governance
  - A good and effective governance in mining sector may be defined as the capacity to effectively develop, implement and monitor policies and strategies to manage the economic, social and environmental costs and benefits related to mining.
  - This good and effective governance is essential to effect the transformation of the natural capital into other forms of transferable capital for sustainable development.
  - Mining activities, including exploration, development, production, and disposal of minerals generally affect the environment and ecology of the mined areas. Therefore, environmental and social concerns must be addressed sensitively, for which effective governance systems are required to ensure mining in a sustainable manner.
EFFECTIVE GOVERNANCE IN MINING SECTOR

- Mining is a most demanding and location specific industrial sector to manage:
  - Unique characteristics of mineral wealth
  - Complex Socio-economic & environmental issues
  - Mining goes where the ore body is, not where capacity for governance exists.
  - Localised activity.
  - Lack of government capacity
  - Recent community awareness
  - Illegal mining
EFFECTIVE GOVERNANCE IN MINING SECTOR

- **Illegal Mining in India**
  - In India, illegal mining is reported frequently in various ore rich states like Karnataka, Andhra Pradesh, Orissa, Jharkhand, etc.
  - Working by lessees outside the leasehold areas also amounts to illegal mining.
  - Illegal mining can be operated in the surface or underground. Identifying surface or underground illegal mining represents two very different challenges and as such involves two different methodologies.

- **How to Identify Surface & Underground Illegal Mining?**
  - Blasting operations which produce noise, vibration and fumes are a good way to identify illegal mining activities.
  - More traditional methods such as scrapping, digging or screening are most likely in use especially when high value minerals like gold, diamond, precious stones etc. are concerned.
  - Installation of check points and patrols in rural areas or port facilities.
EFFECTIVE GOVERNANCE IN MINING SECTOR

- Satellites imagery and photography taken from unmanned aircraft are now in use to monitor illegal mining in developed countries.
- Information on illegal mining is gathered from local people by the state Government officials in freehold areas.
- The first obvious characteristic is the subsidence due to large scale illegal underground excavation.
- Subsidence mostly occurs in the surface centre of underground mining activities, and the subsidence magnitude decreases from centre to edge, finally forming a spatial funnel in the area. Differential Radar Interferometry (DInSAR) appears to be the most adequate technology for underground for mining-induced subsidence detection.
- ‘Landscape archaeology’ combines satellite imagery with Global Positioning System data to lease out a landscape's hidden details, such as long-buried roads and canal systems.
EFFECTIVE GOVERNANCE IN MINING SECTOR

Recommendations:

Steps taken to curb Illegal Mining

- Section 23(C) of Mines and Minerals (Development and Regulation) Act, 1957 empowers the State Governments to frame rules to prevent illegal mining and the State Government may, by notification in the Official Gazette, make such rules for preventing illegal mining, transportation and storage of minerals and for the purposes connected therewith in the State.

- Ministry of Mines have formulated a three-pronged strategy for prevention of illegal mining viz. constitution of Task Force by the State Government at state and district level having a representative of IBM.

- Ministry of Mines has directed the State Governments to conduct special drive to increase awareness on the issue of illegal mining by organizing ‘Pakhwara’ (Fortnight Programme) in liaison with the office of IBM in the State.
EFFECTIVE GOVERNANCE IN MINING SECTOR

- IBM has nominated Nodal Officers for every regional offices to look after all the work of prevention of illegal mining activities, coordination and liasoning with respective regions/States.

- To reinforce mechanism to control illegal mining, the State Governments were advised to:
  - Set up State Coordination-cum-Empowered Committee (SCEC) to coordinate efforts to control illegal mining by including representatives of Railways, Customs and Port authorities.
  - Frame State Mineral Policy on the basis of model Mineral Policy drafted by the Ministry of Mines and to adopt transparent concession grant policies to reduce scope for illegal mining.
  - To adopt an Action Plan with specific measures to detect and control illegal mining including, use of remote sensing, control on traffic, gather market intelligence, registration of end-users and setting up of special cells etc.
EFFECTIVE GOVERNANCE IN MINING SECTOR

- **Use of Modern Technology to curb Illegal Mining**

- Geo-referencing of Mining Leases: Geo-referencing of Mining leases allotted to various agencies would help in curbing the illegal Mining activities.

- DGPS survey: To avoid disputes on boundary and position of mining lease area, DGPS survey which has sub-centimetre accuracy is a possible solution.

- Satellite Imagery to curb Illegal Mining: Satellite Imagery can be useful in detecting illegal mining by tracking of mining activities in the area.

- ISRO Imagery to curb Illegal Mining: The Indian Space Research Organization (ISRO) is the latest ally to curb the illegal mining by providing satellite imaginaries of the mining area.

- GPS devices to check Illegal Mining: GPS (Geographical Positioning System) can be very useful tool in detecting and curbing illegal mining.
CHAPTER - VI

GLOBAL REPORTINGS STANDARDS AND RANKING SYSTEM

- Preamble
- Global Reporting Standards
- Ranking System for Mining Companies
GLOBAL REPORTINGS STANDARDS AND RANKING SYSTEM

- **Preamble**

- Mining activities have a significant environmental impact which needs to be tackled through effective environmental management system, effective mine closure planning, restoration of ecological balance, and observance of best mining practices to ensure maintenance of critical natural capital.

- Environmental Impact Assessments as part of environmental management system should integrate environmental responsibilities into everyday management practices through changes in organizational structure, procedures and processes.

- Therefore, we must care for sustainability of the mining operations and prepare reports following certain guidelines and publish them to help all other countries.

- Ranking system of mining companies should be done based on their performance in various aspects of mining sustainability.
GLOBAL REPORTINGS STANDARDS AND RANKING SYSTEM

- **Global Reporting Initiative (GRI)**
  GRI is a network-based organization that has developed the world’s most widely used sustainability reporting framework. ([http://www.globalreporting.org/Home](http://www.globalreporting.org/Home))

- **GRI Reporting Framework**
  - GRI's Reporting Framework is developed through a consensus-seeking, multi-stakeholder process. Participants are drawn from global business, civil society, labour, academic and professional institutions.
  - Reporting Framework sets out the principles and Performance Indicators that organizations can use to measure and report their economic, environmental, and social performance.
  - The cornerstone of the Framework is the Sustainability Reporting Guidelines and available on the net.
  - Other components of the Framework include Sector Supplements and available on the net.
GLOBAL REPORTINGS STANDARDS AND RANKING SYSTEM

- Global Reporting Standards
  
  - There is no international organization capable of passing and implementing performance standards for the mining industry as a whole. However, there is a great need for such standards and this may be done by consensus.
  
  - Some of the reporting standards, each having a particular focus, some distinct and others overlapping are given in the Annexure.

- Ranking System for Mining Companies

- Ranking system of mining companies should be done based on their performance in various aspects of mining sustainability. The key issues are:
Ranking System for Mining Companies

Ranking system of mining companies should be done based on their performance in various aspects of mining sustainability. The key issues are:

- Biodiversity/Ecosystem services and general environment
- Financial (KPIs): Fundamentals, Profit Margins, Growth Rates, Financial Strength, Analyst Estimates
- Health and Safety Management at work; Occupational diseases; disabilities due to occupational diseases or work related accidents.
GLOBAL REPORTINGS STANDARDS AND RANKING SYSTEM

- Labour, Social Performance Indicators (SPIs): Product Responsibility, Community development, Human Rights, Diversity & Opportunity, Employment Quality, Living conditions, Welfare amenities provided by the company
- Artisanal and small-scale mining
- Rehabilitation and Resettlement
- Closure planning / mine closure plan
- Productivity and production with safety, efficiency, economy with due regard to the conservation and the environment.
HRD IN MINING
CHAPTER - VII

HUMAN RESOURCE DEVELOPMENT IN MINING SECTOR

- Preamble

- Availability and Requirement of Human Resources in Mining Sector in XII Plan (2012-17)

- Measures for Capacity Building of Infrastructures

- Modernization and updating of Curriculum and Technology
HUMAN RESOURCE DEVELOPMENT IN MINING SECTOR

Preamble

- Mining Industry in India is the largest employer. The rapid expansion with increasing investment in mining sector and to ensure the modernization process successful and sustainable development, it is necessary to strengthen the infrastructure of Human Resource Development and Training.

- The National Mineral Policy -2008 aims at attracting private investment both domestic and foreign direct investment along with the state-of-the-art technology for exploration and mining. The policy also envisages level playing field for public and private sector. The increasing investment will also need more skilled manpower in this sector.

- Need to re-engineer the current human resources to enable to meet the requirements of the industry. This calls for corrective action by training of manpower in key areas, institutional strengthening, curriculum development, training of trainers, faculty development, introduction of new & advance courses, networking with national & international agencies thereby promoting collaborative approach, evolving a long time human resource planning for the mining sector, & establishing linkages between academia and industry.
HUMAN RESOURCE DEVELOPMENT IN MINING SECTOR

Availability and requirement of Human Resources in Mining Sector in XII Plan (2012-17)

As per the report prepared jointly by Ministry of Mines & Confederation of Indian Industry the projected figure of employment in mining sector by the year 2017 will be more than 10.60 lakhs. Similarly by the year 2025 the figure will be more than 12.10 lakhs. The sector wise projected figures are as follows:

<table>
<thead>
<tr>
<th>Sector</th>
<th>Current</th>
<th>2017</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exploration &amp; Regulatory</td>
<td>20,565</td>
<td>24,854</td>
<td>25,828</td>
</tr>
<tr>
<td>Fuel (Coal &amp; Lignite)</td>
<td>767,761</td>
<td>783,997</td>
<td>891,240</td>
</tr>
<tr>
<td>Metallic &amp; Non Metallic</td>
<td>116,029</td>
<td>87,762</td>
<td>294,098</td>
</tr>
<tr>
<td>Minor Minerals</td>
<td>87,762</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>992,117</td>
<td>1,067,173</td>
<td>1,211,166</td>
</tr>
</tbody>
</table>
HUMAN RESOURCE DEVELOPMENT IN MINING SECTOR

- **Recommendations:**
- **Measures for Capacity Building of Infrastructures**

In the study made by CII about the skill gaps in Planning, Operation, Maintenance and Safety in Mining Industry are observed. To bridge the gap between demand and supply of the human resource and also to update the knowledge in tune with the advancement in technology, the following initiatives are required for capacity building of infrastructure:

- **Education related measures:**
  a) There is a demand supply gap in Mining Engineering graduates and Diploma in Mining Engineering category in the sector. In Institutes like IITs, ISM, BHU and other educational institutions, the nos of seats for mining courses to be increased and new courses and scholarships need to be introduced.
  b) To support the growth of the mining sector there is immediate requirement to start courses for mining lawyers, mineral financial analyst/economist. Also new courses such as Diploma in mining machinery, M.Tech in spatial technologies, etc. needs to be introduced.
c) Skill Development Measures:

a) Mining industry is currently facing huge shortage of trained manpower such as blaster, shot firer, drillers, heavy machine operators, surveyor, etc. To address this issue is through introduction of relevant courses in the existing ITI/ITC and imparting refresher

b) Regulatory process need to be developed through DGMS / IBM etc. to ensure that the accreditation process of skill imparting institutions are of requisite quality and only person with requisite diploma are employed with them.
HUMAN RESOURCE DEVELOPMENT IN MINING SECTOR

Modernization and updating of curriculum and technology

a) The academic institutions and the mining industry can come together to institute undergraduate and post graduate mining engineering courses that would serve as (i) orienting non-mining engineers for the mining industry and (ii) to encourage mining engineering diploma holders employed in industry to pursue higher education.

b) There is a need to build networked institutions of excellence for building synergies of strengths and focuses of different academic and research institutions, be private, public or non-profit sectors.

c) Many of the talented students in mining engineering discipline are going for non-mining jobs because of more attractive emoluments and perks. Some of the students go for management study and hardly few for higher studies in mining. In order to attract the talented students to the mineral sector, it is essential to enhance the emoluments and perks to make the jobs more attractive.