

## **16. ENVIRONMENTAL PROTECTION AND RECLAMATION OF LANDS DAMAGED BY MINING**

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### **16.1 EFFORTS MADE BY INDIAN BUREAU OF MINES**

The Indian Bureau of Mines (IBM) continues to strive ahead in protection of environment in mining through scientific mining and in that process, the air quality standards and the effluent standard for mine discharge, within the work zone environment, have been set and is under constant monitoring of the department through MCDR inspections. IBM has also set up the standards for the closure of mines. For better reclamation and rehabilitation along with scientific mining, attempts in formulating statutes on minimum areas for grant of mining leases are also made. As a result of implementation of environment Statutes, combination of Rules & Legislations and approval of mining plans/schemes of mining by IBM through MCDR inspections, enormous environmental input has taken place in mining areas. Besides various statutes framed for protection of environment, Technical Consultancy services provided and promotional research undertaken on pollution control and environmental management, celebration of MEMC weeks, etc., persistent improvements in the protection of environment over the years were noticed. The achievements in different aspects of environment inputs are given below.

### **16.2 TECHNICAL CONSULTANCY & PROMOTIONAL RESEARCH RENDERED BY IBM**

Mining Research Cell (M.R. Cell) of Indian Bureau of Mines was established in 1972 with a view to carry out applied mining research in mining & geological fields. Since its inception, applied research assignments were taken up in various metalliferous mines on many aspects viz. to determine optimum production, for improvement in the productivity, performance studies of machinery and improvement in blasting efficiency. These all are purely research-oriented projects. In the year 1992-93, based on the growing urgent needs of the mineral industry, M.R. Cell has taken up a promotional study on environmental pollution and control measures in mines and processing plants for suggesting mitigation measures which include generation of environmental baseline data and environmental auditing. Since then, there was tremendous change in work of M.R. Cell and it's main activities are focussed towards the environmental aspects on mining.

Mining Research Cell has developed a strong technical base comprising pool of highly trained manpower of mining engineers, mining geologists and technical staff to conduct environmental investigations of mineral based industries. The M.R. Cell has gained expertise ranging from formulation of environmental projects, generation of environmental monitoring data required for the preparation of Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) to generate optimum information for decision making. The Baseline Data generation on environmental work for four seasons involves monitoring season-wise climatic details, air, water, noise and soil qualities details, and also collection of data on demographic profile, land use pattern, flora & fauna, socio economic details blast vibration studies, hydrological studies, soil

erosions etc. for which IBM is fully equipped with the state-of-the-art instruments. The IBM Environment Laboratory is well equipped with all the facilities for analysis of all the required parameters and recognised by Central Pollution Control Board given by MOEF. The personnel engaged in this field of analysis are highly qualified, well trained and have up to 25 years of experience and expertise in the above fields.

### ***Promotional Research***

Keeping in view the growing technological needs of mining industry, the Mining Research Cell has conducted several promotional research projects on mining environment. Some of the important projects include :

- ◆ Status of environmental pollution, abatement measures in mines and attached beneficiation plants of some of the manganese and iron ore mines.
- ◆ Preparation of EIA/EMP for four mines belonging to Sikkim Mining Corp., under North- Eastern developmental Programme.
- ◆ Preparation of EIA/EMP for Limestone Mines of Assam Mineral Development Corporation Ltd. under North-Eastern Regional Developmental Programme.

Apart from the above, the MR Cell of IBM has carried out and implemented the following promotional projects.

#### **16.2.1 International collaboration project on "Development of application techniques in relation to environmental management of mines and waste recoveries"- Completed.**

Under the functions of Applied Research and to update its technical capabilities and for the transfer of state-of-the-art technology for carrying out environmental studies in the field of mining and ore dressing, a joint collaborative project with B.R.G.M. (France) was taken up in the year 1996, titled "Development of application techniques in relation to Environmental Management of Mines and Waste Recoveries". Under this study, Regional Environmental Impact Assessment and Regional Environmental Management Plans for two selected areas, in North Goa Iron Ore Mines and Sukinda Chromite Belt in Orissa were done. The project work was completed in June 2000 and the reports were submitted to the Ministry.

For the above two areas, baseline data was generated and processed in respect of air, water, soil, sediments and noise qualities. Biological sampling & ground vibration studies were also carried out. Selection of stations for monitoring these data was done based on the principle of source of pollution, its pathway and the location of receptor. Ambient air quality was also monitored using continuous monitors and with the "DusTrak", which can analyse the RPM with 50% cut-off at 4 microns. Climatic data for one full year, in each area, was monitored by installing electronic automatic weather stations. Socio-economic studies and land use plans for these areas were also prepared and incorporated in REA report. Regional base plans were prepared using the GIS

package 'Map Info'. The database was computerised using access programme. Evaluation and interpretations of this database was carried out for the purpose of risk assessment. Mitigation measures at the regional level, for each region, were incorporated in respective regional environmental management plans.

#### *Salient findings of REA Report for Sukinda (Orissa) area*

Surface water quality exceeds the standards for drinking, outdoor bathing, aquatic life and fish in respect of Chromium. Surface water is suitable for irrigation in the upper part of the valley only. Ground water quality exceeds the standards for drinking water in most of the wells that were investigated in terms of Cr (VI), Ni & Hg. This is for the first time that Mercury as pollutant was discovered in this area. Paddy sediment quality exceeds the threshold value for Cr in agricultural soil in most of the fields and Ni & Hg in a few places investigated. Hg does not meet the standard for aquatic life. Air quality does not meet the RPM and/or SPM standards at some of the villages and in the active dumps.

The fine tailings from the Sukinda chromite ore beneficiation plants contain residual chromite recoverable by gravity treatment. It is possible to purify tailings in which the  $\text{Cr}_2\text{O}_3$  content falls below 8%. The present ore processing operations generate considerable tailings, which are poorly controlled and released into the surrounding environment. These products are subject to natural drainage and leaching, which generate chemical pollution of the water. Some waste dumps in the area still contain recoverable chromite, representing an additional resource along with the nickel present in the limonitic fraction. Bench scale beneficiation tests carried out have indicated that this chromite can be concentrated.

#### *Key corrective actions suggested at the regional scale*

- Management of CrVI, Hg and Ni – bearing surface waters, mainly by implementing cost effective and affordable bio-remediation techniques,
- Management of Cr bearing paddy field sediments,
- Management of waste dumps outside the mining lease,
- Improvement of infrastructure such as roads, water supply, truck washing facilities,
- Development of green barrier to contain air and noise pollution,
- Epidemiology study to determine the extent of the impact of Cr (VI) on human health in Sukinda valley.

#### *Salient findings of REA Report for North Goa area*

Under the air quality, the RPM & SPM values were observed to be exceeding the limits at all work zones and at the villages and  $\text{SO}_2$  &  $\text{NO}_x$  values exceeding at a few locations. Under the noise monitoring, noise levels from some equipment like dozers & dumpers and the work zone exceed the threshold values. Ambient noise levels at two villages, where truck traffic is high, exceeded the limits.

In respect of surface water, Fe & Mn concentrations are observed to be exceeding the drinking water standards. Higher Mn and Fe concentration is also observed in the pit water. Mn concentration in ground water was also found to be exceeding the limits.

Salinity in the ground water is also found at few places near the meander of the Mandovi river. Samples from nala & paddy field sediments show high concentration of Fe.

Fine tailings from three of the main beneficiation plants still contain iron particles that can be recovered by relatively simple gravity treatment. Recovery of these iron ore fines also helps to reduce the volume of the tailings from the beneficiation plants, which are stored in large tailing ponds, causing significant land degradation.

***Key corrective actions suggested at the regional scale***

- Improving road infrastructure and development of green belt to contain air and noise pollution in ore and waste transportation from the mine to beneficiation plants, loading points or dumping sites located outside the lease areas;
- Land use management involving:
  - the management and rehabilitation of waste dumps outside the mining lease,
  - the management of waterways and watercourses contaminated by suspended solids.

Presentation of findings of REA reports prepared in respect of study sites in Goa and Sukinda areas were held at Goa and Bhubaneswar in Jan. 2000 and Feb. 2000, respectively. Representatives from various respective mine management, Govt./Non Govt. agencies, State Pollution Control Boards, M.O.E.F, scientists, academicians, eminent mining personnel of the region and BRGM experts participated in the above presentations. After this presentation, letters were issued to the mine owners individually in each region to submit action plans to arrive at the mitigation measures, specific to the leaseholds. However, as per the Regional Environmental Management Plans, prepared for each area, the impacts defined are not solely the responsibility of the mine owners, to be controlled within their mining leaseholds. Some of the issues involve the collective responsibilities of both governmental bodies and mine owners and few of them purely by governmental agencies. Therefore, Ministry of Environment and Forest, being the chief regulatory authority for the pollution control and environmental management, was requested to initiate actions in respect of the environmental issues pertaining to the regional level, by constituting regional environmental committee at each mine site, i.e. Sukinda (Orissa) & Goa, for the coordination among the mine owners, different government bodies and other agencies.

Under this project, Officers of M.R. Cell of IBM were also trained in preparation of EIA, REA, EMP & Risk Analysis. The M.R. Cell is also equipped with sophisticated equipment for environmental monitoring and the officials were also given hands-on training on the use of these instruments. With the result, the M.R. Cell has developed state-of-the-art expertise to take up any challenging jobs relating to Environmental Management in mines, including preparation of Regional Environmental Impact Assessments & Management Plans, Risk Assessment & Disaster Management Plans and Environmental Auditing.



#### **16.2.2 S & T project on 'Study of Pollution Level in asbestos mines and process plants in India - Completed.**

Ministry of Mines has imposed a ban on grant, renewal and expansion of asbestos mining in the year 1986 after careful consideration that as asbestos mining has deleterious effect on the health of the workers and exposes them to diseases like silicosis and pneumoconiosis etc. Therefore, no expansion in the mining of asbestos henceforth be permitted. In view of the increasing demand for asbestos and increasing level of import, the Govt. has decided to have a second look whether asbestos mining and processing can be expanded by taking appropriate control measures to keep the dust level below the prescribed TLV (threshold limit value). For this purpose, M.R.Cell of IBM, has taken up the S & T project titled 'Study of Pollution Level in asbestos mines and process plants in India for lifting ban on asbestos mining' in the year 1998. The study was completed in March, 2000. The National Institute of Occupational Health is associating in this project for collection of air borne dust sample and for evaluation of asbestos fibre in the work environment of asbestos processing plant of Pulivendla area of Andhra Pradesh and in Rajasthan. The results of airborne samples collected jointly by IBM-NIOH shows very encouraging results in the work environment of various operations in the plant. It was found that in automatic plant, the dust level in work environment was within the prescribed TLV (two fibre per cc), whereas in semi automatic processing plants it was observed that in few operations like screening and digitizer, the values are higher than the limits. Thus, there is a scope for improvement in the operations for modernisation of semi-automatic plant with indigenous technical know-how to keep the exposure of dust level within the prescribed TLV. The presence of asbestos fibre in work environment of mining area is still lower than the prescribed TLV. The report of this study was submitted to the Ministry.

#### **16.2.3 S & T Project on "Attenuation of Hexavalent Chromium in Sukinda Chromite Belt of Orissa State by Bio-remediation Technology" - under implementation**

IBM in collaboration with BRGM, France, has successfully completed a Project on "Development of Application Techniques in Relation to Environment Management of Mines & Waste Recoveries". Under this project, Sukinda Chromite Belt in Orissa State was taken as one of the mines specific site in preparation of Regional Environmental Impact Assessment and Regional Environmental Management Plan. As an outcome of this study, the presence of Hexavalent Chromium as a pollutant, which is carcinogenic, was identified in this area. The intensive contamination of hexavalent chromium, was identified in the chemical analysis of samples collected from various environmental sources such as surface water, ground water, pit water discharge, leachet from the waste dumps & tailings, soils, plants, vegetation, aquatic life, etc. As per the chemical analysis results arrived in respect of fruits, paddy, fish, milk, etc. from this area, this contamination is observed to have entered even into the food chain. To elaborate this study, BRGM has taken up a development project titled, "Impact of the Monsoon - Related Flooding - De-watering Cycle on Water Quality of Sukinda Chromite Mine in Orissa - India". The analysis results of this study have revealed the presence of hexavalent chromium as high as 3.4 mg/lit in surface water, 0.6 mg/lit in ground water,

2.1 mg/lit in pit water and 1.9 mg/lit in pit seepage water. In some of the abandoned pit, content of hexavalent chromium is as high as 4.5 mg/lit.

In some of the mines, the treatment in vogue for attenuation of hexavalent chromium is by the application of ferrous-sulphide. This process is not to be Eco-friendly, as it involves consumption of large quantity of chemicals, resulting in decrease of pH of the treated water, requiring further neutralisation by adding lime. Therefore, for attenuation of this hexavalent chromium, BRGM, France, has carried out experiments in the laboratory on "Attenuation of chromium (VI) through biological treatment" i.e. by allowing mine effluent water to pass through the paddy fields for the reduction of hexavalent chromium to trivalent chromium. The results were successful and they found that the Cr (VI) content as high as about 6.0 mg/l could be reduced to the permissible limits of drinking water at 0.05 mg/l, within 24 hours duration. However, the questions remained whether this Cr (VI) is absorbed by the plants or the soil & whether the converted Cr (III) is stable or it reverses back to Cr (VI) after passage of time? Further, on the pilot scale, it is necessary to demonstrate the flow rate requirement of the effluent water into the paddy field and the requirements of the area of paddy field and the density of paddy crops to be planted for the attenuation of Cr (VI). BRGM in their report have suggested that after harvesting the paddy crop, it has to be burnt and buried, so as to prevent the entry of Cr (VI) from the contaminated crop into the food chain. This results in the wastage of the cultivated crop, without making any proper use of it. To prevent this, it is also necessary to examine whether any other type of cultivation can be adopted, which can prevent the entry of Cr (VI) into the food chain. With the above objectives of carrying out further field investigation work on the above issues on pilot scale tests, with any required modifications and to demonstrate the results to the local mine management, an S&T project on "Attenuation of chromium (VI) through biological treatment", which is Eco-friendly and cost-effective, is being undertaken by IBM.

#### *Technical Consultancy Services*

The M.R. Cell is carrying out consultancy works on Environmental Monitoring in mines and in their ore dressing plants and in cement plants, covering four seasonal data - Generation of Environmental Baseline Data & preparation of EIAs and EMPs; Environmental Auditing; Preparation of Risk Assessment & Disaster Management Plans; and Blast Vibration Studies and Geo-technical Investigations. The consultancy services provided by M.R. Cell are as per the approved rates by the Ministry of Mines, Govt. of India, on no loss - no profit basis. Further, special approved concessional rates are provided for Category B mines and these rates are almost 38% of A category mines.

Preparation of EIA involves generation of data base on all environmental parameters, Preparation and Evaluation of database, preparation of risk assessment and arriving at the environmental impacts of different Parameters, estimation of Ground Level Concentrations of different Pollutants and preparation of Environmental Impact Matrix. Preparation of EMP is based upon EIA and by drawing the priorities on risk assessment made, working out mitigation measures for reclamation and rehabilitation of land, flora & fauna, pollution control measures for air, water, noise and soil qualities, design of waste dumps, tailing ponds, drainage system, Water Treatment/Sedimentation Plants/Check

dams & Green Belts, preparation of land restoration plans, arriving at future monitoring requirements and financial aspects. The blast vibration studies, as a part of EIA study, involve monitoring of minimum of 30 blasts with the equipment in the field as per the Directorate General of Mines Safety norms, generation of database, evaluation of data and preparation of regression equations to arrive at safe charge per delay. Considering the requirement of Mining Industry, M.R. Cell has carried out so far over 50 of such environmental assignments on consultancy services.

The important mine environmental projects handled under the technical consultancy so far include:

- Generation of environmental baseline data for the preparation of EIA & EMP: Base metals, iron and limestone mine.
- Preparation of EIA & EMP: Limestone mine including the Captive Cement Plant (L&T), Iron ore, Chromite, Gold, Silica Sand, Multi-metals (Copper, Lead & Zinc), Magnesite.
- Preparation of Risk Assessment & Disaster Management Plan : Chromite mines.
- Environmental Auditing: limestone mine
- Monitoring of ground vibration due to blasting in mines, for the protection of Archaeological and Historical Monuments, Residential houses : Bauxite, Limestone, Iron ore, Magnesite mines.
- Preparation of Risk Assessment and Disaster Management Plan – Chromite mines.
- Environmental Auditing : Limestone mine of GACL, Himachal Pradesh.
- Noise Level Monitoring at Barge Loading Stations for Export of Iron ore from Goa.

The M.R. Cell of IBM is assisting their clients through its technical consultancy services, in getting their environmental clearances from Ministry of Environment & Forest (MoEF), Govt. of India and the State Pollution Control Boards (SPCB). Some of the salient achievements are furnished below:

- The M.R. Cell's consultancy work is based upon the specific problems, which other consultancy agencies cannot offer. For example, the EIA and EMP prepared by different parties, for Sandur Iron Ore Mines in Bellary area of Karnataka, located in hilly terrain, as pointed by MoEF, were not properly reflecting the problems and management of waste disposal. Thereafter, IBM was approached for preparation of solid waste management plan. Accordingly, M.R. Cell has prepared a solid waste management plan, based on which, the MoEF has given the clearance.
- Similarly, Industrial Development Corporation Ltd. of Orissa State has approached IBM for the preparation of EMP for their limestone-mining lease, in which rehabilitation of villagers was involved. Later they also approached for the clearance of their mining lease in respect of their Chromite Mine where there was a problem with hexavalent chromium (a carcinogenic substance) and also inundation problem from the adjoining river. Accordingly, the risk assessment & disaster management plans were prepared and submitted.

- Hutti Gold Mines has approached IBM for the preparation of EMP, which involved proper design of their tailing dam where cyanide released from their treatment plants is entering into a seasonal nalla passing through the lease. Accordingly the EMP including the design of tailing dam was prepared and submitted.
- EIA/EMP for Hirmi Cement Plant & Captive Paraswani Limestone Mine of L & T were prepared, as per request received from the party, for first time, covering captive cement plant also, thus expanding M.R. cell activities to cement plants. This report was prepared enabling the party to get clearance from Ministry of Environment, for the expanded production. Under this report, GLC of various stack emissions at nearby residential areas, were estimated using dispersion models. For this purpose, total plume height required was also arrived at.
- For getting the forest and environmental clearances in respect of mining lease, the comprehensive EIA & EMP was prepared and submitted for the ACC, in respect of their Walayar Limestone Mine, in Coimbatore Distt of Tamil Nadu. This report includes the protection measures for the BG rail track passing through the lease area and for the reserve forest in which straying of wild life, such as wild elephants, were noticed. As Coimbatore is a draught prone area, implementation on recharge of the ground water and water harvesting system were also suggested.
- As per request from the mine owners, the M.R. Cell has taken up an assignment for the preparation of EIA & EMPs for a group of 15 silica sand mines located near the sensitive Badkhal and Surajkund lakes (where Hon'ble Supreme Court of India, has passed strictures), in order to assess their environmental impact. For acquiring environmental and site clearance, the mine owners were assisted in respect of filling an application form and answering the requisite questionnaire. Salient observations with respect to hydrology and water balance system of the area were furnished. Impact on hydrology due to mine de-watering over the adjacent wild life sanctuary in Delhi area was evaluated to facilitate them in filing the affidavit in Hon'ble High Court of Haryana. As per the request received the EIA & EMP reports falling near Aravali area, at the Public Hearing, in the presence of HSPCB, Revenue & Forest officials, NGOs enabling them to obtain NOC from the State Government were presented. The parties were assisted in filing the applications and the questionnaires for the environmental clearances received from MoEF were duly answered.
- As per the request received from Haryana Pollution Control Board following the order passed by Hon'ble Supreme Court of India on the Public Litigation, Regional EIA & EMP for Silica Sand Mines in Faridabad were prepared. The report was completed on war-footing basis and submitted. Iso-packs showing the ground level concentrations of air pollutants were developed for the first time, to evaluate the impact on nearby sensitive areas. The salient features were development of green belt surrounding the crusher zone located in the middle, development of check dams and recharge wells to recharge ground water and to

reduce evaporation losses, provision of settling tanks, restricting on grant of ML near by Suraj Kund and Badkal lake areas, vigorous plantation of Neem trees to reduce selenium content in ground water.

- As per the request received from Archeological Survey of India, on the public litigation filed in the Honourable High Court of Rajasthan on the damages apprehended on the historical Chittorgarh Fort due to blast vibrations from nearby mines, study was conducted and the report was submitted that the blasting vibrations are not causing any damage to the fort. Based on this study, the earlier ban imposed on blasting operations by the court was duly vacated.
- As per the request received from the Hutti Gold Mining Company Ltd., a Karnataka State Govt. Undertaking, for their Hira-Buddini Gold project, an assignment was taken up by M.R. Cell and the Draft Rapid EIA & EMP covering one seasonal data have been prepared and submitted for the conversion of the Prospecting License into a Mining Lease and to get environmental clearance from the State Pollution Control Board and from MOEF. This report includes the proposal for the treatment of fluoride content in drinking water, which is found to be exceeding the limits. Preparation of comprehensive EIA & EMP covering four seasonal data is under process.
- As per the request from Goa iron ore mines exporter association, the M.R. Cell has carried out a noise level study surrounding the barge loading points used for the export of iron ore in Goa. Based on the public litigation filed by the residents about the disturbances in night sleep, strictures have been passed by the Honourable High Court of Mumbai, about loading operations, especially during the night. This study was aimed for evaluation of noise pollution effects generated during the barge loading operations over the surrounding villages.
- Apart from above, in recent years, the M.R. Cell has also started preparation of REIA (Regional Environmental Impact Assessment) and REMP (Regional Environmental Management Plan) covering cluster of mines. This is becoming mandatory for the MOEF for granting fresh mining leases. Therefore, this has become a significant achievement for M.R. Cell for helping the mining industry and at the same time rendering assistance to MOEF for their decision-making on Grant/Renewal/Termination of mining leases based on the pollution load and carrying capacity of the area. One such assignment offered by the State Pollution Control Board of Haryana on Silica Sand Mining in Faridabad area was completed and submitted, enabling them to file an affidavit in the Honorable Supreme Court of India.
- Assisted SAIL in fixing the environmental standards for iron ore mines in India.



### 16.3 OTHER ASSISTANCE RENDERED BY IBM

#### *Assistance to MOEF*

M. R. Cell is also assisting the expert committee appointed by MOEF for clearance of proposals for grant of mining leases. It is also receiving the research project proposals on mines and minerals from MOEF for the clearance and comments are being sent to MOEF based on their improvements and on the methodology to be adopted.

#### *Assistance to BIS on ISO 14000 Series*

The M.R. Cell is aware of R&D developments through primary (Research), Patents, Standards, Conference, Proceedings, etc. in the field of environment. For the sustainable development of mining industry, keeping in view the present trend in world market, as a member of Chemical Head Division, the M.R. Cell is assisting the Bureau of Indian Standards in formulating ISO 14000 series proposals. The M.R. Cell has given their comments on several amendments/additions under these series and also in introducing new items of work/amendments to the existing series, with special concessions to small & medium entrepreneurs. It is also giving comments to vote by India, either for or against on the amendments received from time to time. Based on the EIA & EMP report prepared by IBM the first ISO 14001 certification in India was awarded to a bauxite mine in Maharashtra.

#### *Assistance ESCAP Committee*

The M.R. Cell has been assisting ESCAP Committee, constituted by UN, on the sustainable development of mineral sector in India and necessary recommendations have been sent.

### 16.4 MCDR Inspections & Celebration of Mines Environment & Mineral Conservation Weeks

The IBM continues to strive ahead in the protection of environment in mining through scientific mining and in that process, the effluent standard for mine discharge has been set and is under constant monitoring of the department through MCDR inspections. For better reclamation and rehabilitation along with scientific mining, attempts in formulating statutes on minimum areas in grant of mining leases are also made.

Mine owners are also complying with stipulations laid down in the environmental management plan, as a part of the approved mining plan, which is the statutory instrument for overseeing the environmental management by IBM. Efforts like proper stacking of over burden and rejects and stabilising them, construction of check dams for preventing pollution of natural water cover, etc., Scientific waste dump management are being promoted besides due monitoring of the quality of air, water, etc.

In addition to above, it was also felt that active participation of the mining industry is a must for mitigating and minimizing the damage caused due to mining. The IBM is organising celebration of "Mines Environment & Mineral Conservation Weeks" across the length and breadth of the country covering almost all the mines. The IBM is implementing such weeks under the aegis of its various regional offices located

throughout the country. Since over a decade, the IBM has been successfully organising such weeks at various mining centers.

These weeks are celebrated once a year in region of offices of the IBM. At present, selected mines in each category i.e. mechanised, semi-mechanised and manual participate in these weeks and depending upon their performance prizes are awarded, in selected areas of environmental protection for which competitions are held. Inspections of these mines are carried out by inspection teams consisting of at least 3 members including an IBM officer. The marks are allotted by members of these teams and the IBM Officer, usually of the rank of Dy. Controller of Mines acts as a moderator. While one member of the inspection team is a senior member from management of a mine, the other member could be an Officer of the concerned State Directorate of Mines & Geology, a representative of the mine owners or Federation/Association of mine owners, (if any) or from the State Forest Department or Pollution Control Boards. The Regional Controller of Mines of the concerned region acts as the convenor and Chief Moderator. The marks allotted by the inspection teams are then placed before an Evaluation Committee which is headed by the Controller of Mines of the concerned zone. It consists of the seniormost Dy. Controller of Mines of the region, a few senior mine officials, representatives of the local mining associations of mine owners and mine managers/mining engineers as well as senior office bearers of local recognised trade unions.

Based on the assessment of the evaluation committee, mining shields for each category of mines are awarded for overall best performance as well as for best performance in each area of environmental protection at the concluding function which is usually held in State capitals and/or at important cities or towns.

Souvenirs are also brought out which contain good documentation of the efforts being made by the industry and concerned agencies to protect environment in mining areas in the form of contribution of articles from knowledgeable persons connected with the industry. So far over 20 lakh saplings have been planted by mine owners since 1989.

As a result of the combination of Rules & Legislation, approval of mining plans/schemes of mining/celebration of MEMC weeks, MCDR inspections, etc. persistent improvements in the protection of environment over the years were noticed. The achievements in different aspects of environment inputs are summarised in the following paragraphs.

#### **16.4.1 Afforestation**

Sustained efforts of mining industry over the last decade have resulted in massive afforestation across the country. Afforestation has been done not only within the mining lease but also outside the mining lease. A total of **58113803** trees have been planted so far in an area of about **26650 hectares of the mines covering different minerals**. The data compiled in this regard is given in the following table. Planting of around 58 million trees with a creditable survival rate of around 70% is a major achievement of mining industry.

### Cumulative status of afforestation in major non-coal mines upto 2001-2002

Sl.No.	Mineral	Mines covered	Area covered (in ha.)	Trees planted	Tree survived	Survival %
1.	Bauxite	83	1636.59	5453764	4100438	75
2.	Chromite	14	370.64	1611193	989416	61
3.	Copper	7	346.16	1320360	836570	63
4.	Dolomite	67	299.88	494293	331954	67
5.	Gold	5	412.00	906400	634480	70
6.	Iron Ore	130	8479.77	24301523	17208191	71
7.	Iron & Mn	31	185.44	564249	416446	74
8.	Lead & Zinc	9	1361.50	697400	610430	87
9.	Limestone	344	8943.55	14125474	10291898	73
10.	Manganese	57	2078.67	5258462	3421926	65
11.	Magnesite	18	500.86	460249	318747	69
12.	Pyrite	1	7	20750	14715	71
13.	Others	404	2028.22	2899686	1922662	66
Grand Total		1170	26650.28	58113803	41097873	70

#### 16.4.2 Reclamation & Rehabilitation

Conscious efforts have been made by mining industry in this regard. Efforts are being made to reclaim the mine before abandonment as well as by way of reclamation concurrent with mining. The data in this regard is given in the following table.

#### Reclamation & Rehabilitation work done in metalliferous mining areas up to 2000-2001

No. of abandoned mines reclaimed	18
Total area reclaimed in abandoned mines	461.185 ha.
No. of working mines where reclamation & rehabilitation is carried out	450 ha.
Areas of such reclamation & rehabilitation carried out in the above mines	7236.256 ha.

It can be seen that around 7200 hectares of area is under reclamation in working mines. Classic examples of reclamation of mined out area through efforts made by IBM are given below :

- Based on the suggestion given by IBM during MCDR inspection, the management of Naubasta limestone of M/s Jaypee Rewa Cements, Distt. Rewa, MP, converted the mined out area into a water reservoir and developed the same into a picnic spot. Today, the area, which once upon a time was an active mining zone, has been converted into a place for entertainment and the water reservoir has also attracted Siberian birds. The water reservoir has also improved the visual impact of the surrounding areas.

- In another example Bhotang Copper Mine of M/s Sikkim Mining Corporation, East Sikkim was advised to set up a plant for classifying beneficiation plant tailings. In the process 70% of the tailings are recovered and are being used for filling underground mined out stopes. These tailings otherwise used to be discharged into natural watercourse of Teesta river causing pollution. Thus, the pollution effect is minimised to a large extent.
- In case of Maravarperungudi Limestone Mine of M/s Madras Cement Ltd., mining is carried out up to a depth of 2 m. from the surface, being a shallow deposit. During the inspection of the mine, it was observed that no proper back filling of the worked out area was done. The available soil was back filled up to a height of 4-5 m from the floor of the pit i.e. 2-3 m above the ground level, thereby restricting back filling only to a limited area. The party was advised to reclaim the area matching to the ground level, i.e. to cover the height of 2 m only, followed by afforestation. During the subsequent inspection, it was observed that the suggestion has been implemented and the back filling is carried out only up to ground level followed with afforestation. It has been estimated that about 30 hectares of additional area will be reclaimed further, which otherwise would have been left out.

#### **16.4.3 Waste Dump Management**

It has been observed during the MEMC Weeks that in most of the participating mines, waste dumps are maintained as per bye-laws. Efforts are being made to maintain the dumps systematically. In respect of highly mechanised and semi mechanised mines, there is an increasing trend to stabilise the inactive dumps. Suggestions offered by the inspecting teams to form benches, construct retaining walls around waste dumps and to stabilise the dumps in a phased manner by way of afforestation have been well received and implemented by mining industry. For new dumps, boulder bed pitching has also been advised after detecting porosity and permeability of the barren ground so selected.

To cite an example, waste dump management has been done in case of Meghataburu Limestone mine, for the two dumps, which was accomplished by regrading them to 20-25 degrees angle of retention, after boulder pitching and thereafter tree plantation with moonscape catering. The dumping sites have been selected after studying the porosity and permeability of the dumping area. In case of mines of Goa, more than 57 km of laterite bunds have been constructed for stabilisation of dumps. A large number of settling tanks are provided for settling of suspended solids and arresting silts.

#### **16.4.4 Topsoil Management**

Topsoil management was introduced in most of the mines after the commencement of MCDR, 1988. Through the efforts made by IBM through inspections and MEMC Weeks, it has been observed that mine owners have started separate stacking of topsoil. It has been observed that in many cases, the topsoil has been used for plantation. In case of new mines, topsoil has been preserved separately. In some cases, the topsoil has been given to local farmers for cultivation of local crops.

#### **16.4.5 Air Quality Management**

The systematic air quality survey, data generation and then adoption of protective measures for air pollution control is being practiced by all the mines, these being prerequisite for approval of mining plan/mining schemes. It has been observed that regular monitoring of the quality of ambient air through sampling at various specified locations in and around the mines is being done. Dust suppression by water sprinkling is a regular feature in the mines. In major mechanised mines, the dust & gases emitted by various machineries are being regularly checked through the latest monitoring devices. The ambient air quality standards prescribed for industrial and mixed use, residential and rural areas, like SPM 5.0/2.0 mg/m<sup>3</sup>, SO<sub>2</sub> 120/80 ug/m<sup>3</sup>, CO 5000/2000 mg/m<sup>3</sup>, & NOx 120/80 ug/m<sup>3</sup> are adhered to by the mine owners and wherever levels are found above the limits, corrective action is immediately taken.

#### **16.4.6 Water Quality Management**

Introduction of monitoring of sub-surface water quality is the result of MEMC Weeks where the available water resources are sampled, analysed and presented to the inspection teams. Mine water sampling is being carried out at the specified locations particularly at entry points into nallas/rivers and the qualities are being maintained. Discharged water quality is kept within the permissible limits of pH value above 6.5 and below 9 and other parameters like BOD, COD are monitored. Suitable treatment of water or allowing it pass through a settling tank before discharging into natural water courses is a standard practice. In many cases the water is systematically diverted and used for plantation. In the mines with beneficiation plants, the heights of the tailing dams have been increased wherever found necessary. Drawing of the subsurface water and its corresponding recharging is also taken into account in big mechanised mines. Special water bodies have also been created in many of the mines and water from such water bodies is being regularly used for various purposes. In many mines with beneficiation plants, recycling of water and setting up of water treatment plants are the common practices.

In an important example, due to inspection and regular follow up for monitoring of Hexavalent Chromium in mine discharge water, an affluent treatment plant at Chingudi Pal Chromite Mine of M/s IMFA, in Sukinda Valley, Orissa has been commissioned, in addition to the earlier existing plants in this area.

In case of Jaquela-Ou-jacadvicho Mollo (Pal) Mine of M/s Bandekar Brothers Pvt. Ltd. situated in North Goa district, Goa, based on the suggestion given, mine management has constructed settling pond and check dams to arrest the flow of pit water discharge into adjoining seasonal nalla at Ambeshi village.

#### **16.4.7 Noise Quality Management**

Noise levels are being monitored in most of the major mines where heavy earth moving machinery is used. Levels of noise for different types of machineries used in mines e.g. for electric shovels, dozers, etc. are being regularly monitored and mitigation measures taken wherever necessary. To control noise pollution regular maintenance of machine and effective installation of silencers have been undertaken. In mechanised



mines, the operators of heavy machinery have been provided with the ear plugs also. Where heavy blasting is undertaken, vibration studies have also been undertaken by many of the mine owners through reputed organisations and consultants.

#### **16.4.8 General Eesthetic Beauty**

It has been observed during the MEMC Weeks that major mines are making sustained efforts in maintaining the aesthetic beauty of the mines. Planned locations of dumps, plants, residential area along with plantations at these places have given some of the mines a deceptive look. In few cases the abandoned pits have been turned into reservoir and the surrounding are developed into picnic spots. The efforts made by the industry in this regard are noteworthy.

Further, the salient achievements through the celebration of MEMC weeks by the individual regional offices of IBM are furnished below :

##### ***Ajmer Regional Office***

Ajmer region extends over the major part of Rajasthan (barring five districts). This region is richly endowed with manual resources and is dotted with more than 1000 mines with about 340 working mines (only major minerals) employing around 15,000 workers and producing mineral to the tune of 8 million tonnes. The region produces a host of minerals viz. Limestone, Copper, Lead & Zinc, Gypsum, Clay, Soapstone, Asbestos, Barytes, Mica, Quartz, Felspar, etc. and pioneers in the production of Wollastonite (100%), Gypsum (95%), Clay (90%) and Soapstone (46%) which contribute a significant proportion in the all India production.

As a result of persistent efforts, around 10 lakh saplings have been planted in these participating mines during last eleven years of which about 7 lakhs could survive and withstand the furies of nature. Of course, these are the achievements considering the lease area only. Under the jurisdiction of Ajmer Office, a total number of 850000 saplings were planted up to 2002. Out of this 677000 saplings survived, (80% survival). Outside the Mining Lease area, 262000 sapling were planted, out of which 183000 sapling survived (70% survival).

Systematic dumping of solid waste to prevent spillage/wash off, and their reclamation/rehabilitation, wherever possible, have been done and are continually being planned now. In addition, sub-grade minerals are also being stacked separately as readily available material, suitable for blending or upgradation, as and when the time and technology become favourable. Proper and scientific storage of this fraction, which is of utmost importance from the viewpoint of mineral conservation, is now receiving its due importance. Mining activities are scientifically planned and efforts are being made for their implementation in all mines. Dust suppression and control measures, arrangement for air and water quality monitoring, noise and vibration surveys are also being undertaken in most of the mechanised mines of the region.

## ***Bangalore Regional Office***

### **1. Bellary District, Zone-I**

Most of the mines in Bellary district are in forestland. The total lease area of the mines participating in Mine Environment and Mineral Conservation Week this year is about 10047.15 ha, out of which about 8407.86 ha lies in the forest land and remaining area of 1639.29 ha lies in non-forest area. The major environment problems associated with mining in Bellary district are land degradation due to deforestation, damage to agricultural lands and silting of natural water courses due to wash off from the mine workings & dumps and air pollution due to release of dust from various mining operations.

To control wash off flowing into the neighboring areas, 135 check dams and a large number of gully plugs have been constructed. To reduce dust pollution and improve aesthetic value, about 33.8 lakh saplings covering an area of 438.47 ha have been planted within the lease areas. Towards land reclamation and rehabilitation, about 18.5 ha of area of old dumps has been stabilized.

The regular observance of Mine Environment and Mineral Conservation Week in the mines have created considerable awareness in the mining industry towards scientific and environment friendly mining. Preserving the mines environment and the conservation of minerals is the collective responsibility of all the persons connected with mining i.e. mine owner, mine management, staff and the workers. Sincere efforts have been made by some mines to work the deposit in a systematic manner and minimize the environmental pollution due to mining. Based on this, few mines have also gone for ISO certification.

### **2. Gulbarga Zone, Zone II**

Karnataka is a leading producer of cement in the country producing more than 10 million tonnes of cement. The Gulbarga district is endowed with rich deposits of cement grade limestone. The total limestone reserve in Gulbarga district has been estimated to be about 10,000 million tonnes of all categories and grades. The existing capacity of cement manufacturing in Gulbarga district is about 10 million tonnes, which is likely to go up substantially with the coming up of some new green field cement plants.

The major environmental problems associated with mining in Gulbarga district are land degradation to agricultural levels, air pollution and ground vibrations due to blasting. The limestone deposits in Gulbarga district lie under a shallow cover of hills. There is a considerable damage to the agricultural land and large number of families have been displaced and deprived of constant source of income. The agricultural land can not be brought back for its original use after the extraction of limestone. Therefore, sincere efforts were to be made by the mining companies to provide alternative source of income to the displaced families and sponsor social activities for the benefits of the nearby villages. In this direction, it would be desirable to allocate a percentage of the total turnover towards the local area development.

The observance of Mine Environment and Mineral Conservation Week in mines created awareness in the mining industry towards scientific & environment friendly mining. A few mines have also made efforts to achieve ISO 14001 Certification for their mines and plant. However, it will be in the overall interest of the mining industry in the area that all the large mines achieve ISO 14001 certification.

### ***Bhubaneswar Regional Office***

The Bhubaneswar Regional Office has started functioning since 01.04.98 and is now having a jurisdiction of entire State of Orissa. The region has about 250 working mines from about 14 minerals in non-coal mining sector. The State of Orissa has been endowed with vast natural resources. The State constitute 98% of Chromite, 32% of Iron Ore, 31% of Manganese ore and substantial Bauxite and Graphite resources of the country.

The viability of extraction of nickel from the overburden of Sukinda Valley is also a future target. The technology proving plant established by RRL, Bhubaneswar, a joint venture with Hindusthan Zinc Limited, shall be of great interest to waste generation in Sukinda Valley. A majority of the waste can be diverted for extraction of Nickel and Cobalt, which is carrying out of the friable band of the Sukinda valley. Thus, lot of environmental problems posing presently in this area can be solved.

The 'Mine Environment and Mineral Conservation Week' was observed for the 3<sup>rd</sup> year in succession with participation of 57 mines. For the first time, the underground mines of Hindusthan Zinc Limited and FACOR, participated in a special group. The participation has increased from 50 (last year) 57 (this year).

Sixty-five mines have participated in the fifth, 'Mine Environment and Mineral Conservation Week 2002-2003'. During this week, during inspection of these mines, emphasis was given on assessing performance on various environmental protection measures like (1) Afforestation, (2) Waste dump management (3) Top soil management, (4) Reclamation and Rehabilitation, (5) Air Pollution Management (6) Sedimentation & Water Management, (7) Noise & Vibration Survey, Other Scientific Studies and Aesthetic Beauty, (8) Publicity & Propaganda and on Mineral Consumption Measures like (a) Management of Sub-Grade Minerals, and (b) Installation and use of Mechanical Beneficiation Facilities. The number of participating mines is increasing year after year, and efforts are much through the programme, Mine Environment and Mineral Conservation Week, to instill in the minds of the mining operators, the ill effects of mining and the importance of preserving ecology, which has been successful and fruitful.

### ***Dehradun Regional Office***

The jurisdiction of Dehradun Regional Office includes the entire State of J & K, Himachal Pradesh, Uttaranchal, Haryana, Punjab, Delhi, Chhatisgarh territory and part of the U.P. It contains the area of Himalayan region as well as plain of U.P., Haryana and Punjab. The Himalayan region is a fragile region because of incompetent rocks, lush green vegetation with flora & fauna and natural water resources. Similarly plain area of Haryana adjoining the capital of the country is also environmentally sensitive. The

Honourable Supreme Court of India is also providing necessary guidelines to mining community from time to time. In such circumstances more vigilant approach by mining fraternity to safeguard the ecology of the areas is the need of the hour. Dehradun Region is a potential for limestone, dolomite, soapstone, magnesite, silica sand, china clay, quartz, rock phosphate, barytes, gypsum, rock salt, etc.

The 10<sup>th</sup> Mine Environment and Mineral Conservation Week was celebrated by Dehradun Regional Office in the year 2002. During this week, 7 large mechanised mines, 8 small mechanised mines, 3 underground mines, 29 open cast manual mines and 22 small manual mines have participated from Haryana, Uttaranchal and Himachal Pradesh. A significant work has been done in the field of environment protection by the above mines.

It has been observed that in the participating mines around 22.5 lakh saplings have been planted covering an area of around 722 ha. In participating mines of Himalayan region around 500 check dams, 15 km long retaining/parapet walls have been constructed to check wash off of scree material over the down slope of the hills. Further, it has been observed that nearly 830 ha of area have been degraded during the course of mining in the participating mines and out of this 149 ha of area has been reclaimed so far.

After excavation of soapstone up to an economical depth, the area is back filled and is being re-utilised for agricultural purpose. Thus, simultaneous reclamation process is in practice in Kumaon region. In organised sector, air, noise and water pollution measures are being monitored regularly. This is an indication that mining community is well aware of the protection of environment. However, there is still a vast scope to improve the environment in and around the mines.

After the formation of new State of Uttaranchal, mining activity in the State has increased in order to exploit the mineral wealth, particularly in Kumaon area. There are 43 mining lease and 27 prospecting licences granted by the State Govt. in Kumaon region out of which 22 mines of Kumaon region have participated in the week. These mines are very small and production is also limited. Therefore, in order to evaluate their participation in the week a separate group namely "Small Manual Mines" has been formed for the first time in the region.

#### ***Goa Regional Office***

Goa Regional Office has observed 14<sup>th</sup> Mine Environment and Mineral Conservation Week during 2002-2003. During this week 44 mechanised mines and 45 manual mines of Goa, parts of Karnataka & Maharashtra under the jurisdiction of Goa Regional Office have participated.

Iron ore mining of Goa State is export oriented and earning valuable foreign exchange. At present mining in Goa State is faced with complexities due to restricted lease areas, inadequate space for dumping, presence of villages/habitats within close proximity of mining areas and river plots and heavy rainfall. But Mandavi & Zuari rivers, their tributaries and the Cumbarjua Canal have imparted advantage of river

transport to maintain economic viability of Goa's Iron Ore Mines. Goa being an environmental fragile area, mining operation is ought to be carried out in Scientific & Systematic manner with environment protective measures. To start with, a few mining companies have established their own environment cell for undertaking ongoing protective measures & monitoring of various environmental parameters in these mines and some of these have given this work to outside agencies. The efforts are showing encouraging results.

Since its inception, the Mines Environment and Mineral Conservation Council has been celebrating the Mines Environment and Mineral Conservation weeks. But, it was felt that ample scope still exists to augment its activities in the field of education, interaction and sharing experiences in dealing with multiple problems related to mining and environment within and outside lease areas. Consequently, the Mines Environment and Mineral Conservation Council had sponsored/organised a series of workshops for the benefit of Industry personnel viz. Workshop on Returns & Notices conducted by IMA.

### ***Hyderabad Regional Office***

In order to achieve the objective towards conservation of minerals resources and protecting environment in and around the mines and to promote awareness of these important aspects among one and all associated with mining and to create awareness and consciousness among the mining fraternity, Mine Environment and Mineral Conservation Weeks are being organised by Hyderabad Regional Office for the last 8 years in association with Mines Environment and Mineral Conservation Councils and with active cooperation and participation of the mining industry. During this year, 40 large mechanised, medium large mechanised, semi-mechanised and manual opencast mines have participated.

There has been an increase in afforestation in mostly all categories of mines. So far about 2100 ha of area, both within and outside lease, has been brought under plantation and about 29 lakh saplings have been planted with survival rate of 60% to 90%. Around 75 lakh cu m of topsoil have been generated and out of this about 50 lakh cu m has been utilised for reclamation and afforestation. About 118 lakh tonnes of sub grade material has been generated and about 117 lakh tonnes of sub-grade material is utilised. Nearly 39 hectares area is reclaimed by back filling of worked out areas.

Regular monitoring of the quality of air, water, noise and ground vibration is being done mostly in mechanised mines to ascertain any changes and for taking precautionary measures. This reflects the increasing awareness and also the sincerity in approaching towards cause of conservation of minerals and environment protection in and around the mines.

### ***Jabalpur Regional Office***

Mine Environment and Mineral Conservation Week was celebrated for the twelfth time in succession in Jabalpur Regional Office. It gives a wide opportunity to the scientific mass at large to discuss and interact on this burning topic. MEMC week celebration put forth many new and varied recommendations and suggestions which



would go a long way in preserving environment and conservation of minerals by scientific and systematic mining.

The number of participating mines during the year 2002-2003 were 10 mechanised 'A' category mines and 60 semi – mechanised/manual – 'B' category mines. 13 new small mines were included in order to create more awareness amongst this group for the upkeep of the environment and conservation of minerals.

#### ***Nagpur Regional Office***

MEMC weeks are being observed under the aegis of Nagpur Regional Office since 1989-90. This Office has organised 14<sup>th</sup> consecutive week during 2002-2003. These celebrations imbibe a sense of competition amongst the mine operators, which lead to conservation of minerals and protection of environment.

It may be noted that the participation has enhanced from a modest number of 12 to 95 mines. These include 29 mechanised, 132 semi-mechanised and 53 manual mines of the region. This office covers States of Maharashtra, Madhya Pradesh & Chhattisgarh.

The impact of celebration of this week every year is that most of the major mining companies have established Environmental Monitoring Cell. The effort of Nagpur Regional Office has also been acclaimed on All India level by winning the prestigious National Environmental Awards instituted by FIMI by four mines in last six years.

Conservation of Minerals is also being taken care of by way of separate dumping of sub-grade minerals at a pre decided location. Measures have also been taken to prevent wash off of sub-grade minerals from stacks by way of providing bunds, garland drainage, etc. Efforts were also made to utilise 15 to 20% sub-grade minerals by judicious blending.

Topsoil, which is the most precious gift of the nature, has also been removed in advance before undertaking mining operations. Steps were taken to utilise it or to stack it separately depending on the circumstances. Efforts were also made to use it in the nearby agriculture fields.

For afforestation purposes, State Forest Research Institute or Forest Department are being consulted. It has also helped in generating/restoring the local flora of the area.

The celebrations of these weeks have brought about significant and progressive improvements in the mines environment as well as nearby areas. This has also brought about a number of innovations and improvements in mining techniques, conservation of mineral and protection of environment.

#### ***Ranchi Regional Office***

The Xth MEMC week was organised in Ranchi Office in 2002. The Regional Office covers all the districts of Bihar and Jharkhand States except Saraikela and East &

West Singhbhum Districts. In this region 350 mining leases have been granted and during the year 2001–2002 there were 117 working mines, employing 4717 personnel.

This year 45 mines have participated in the Celebrations. Though a large number of mines are of “B” category, the mine management are taking keen interest in participating in these weeks every year. The celebrations of MEMC weeks have resulted in encouraging the mine managements for extensive afforestation activity within and outside mining leasehold areas. Up to the year 2001-02 within the Mining Lease area about 472.42 ha and 111.26 ha of area outside Mining Lease has been brought under afforestation. The total numbers of trees planted are 13 lakhs and 8.8 lakhs, within and outside Mining Lease area, respectively and an average survival rate of about 78% has been recorded.

#### ***Chennai Regional Office***

Tamil Nadu is well known for limestone, garnet sand, ilmenite, rutile, graphite, quartz and felspar and silica sand minerals. Mines located in this area celebrated 5<sup>th</sup> Mine Environment and Mineral Conservation Week (MEMC) during 25<sup>th</sup> to 31<sup>st</sup> March, 2002 to take full care of protection of environment, pollution in the mining area and optimum utilisation of even low grade minerals. Manual mining is being carried out for replenishable deposits of garnet sand along the coast adhering to the MCD Rules and Coastal Regulation Zone (CRZ) implemented by the MOEF. During the year 2001-02, 10 mechanised and 42 other than mechanised mines have participated in MEMC week. The lease areas covered by these mines are 1720 and 325 ha, respectively.

#### **Status of Environment & Mineral Conservation for the last three years in Mechanised Mines (South Zone) as on 31-1-2001**

##### **I Afforestation**

1.	Total number of trees planted	: 138025
	Within mining lease	: 71025
	Outside mining lease	: 67000
2.	Total number of trees survived	: 79607
	Within mining lease	: 56280
	Outside mining lease	: 23327
3.	Survival rate %	: 57.6
4.	Area covered (ha)	: 307.67

##### **II Topsoil**

1.	Total quantity of topsoil generated	: 62.50 lakh tonnes
2.	Total area occupied by top soil	: 25 ha
3.	Total quantity of topsoil stored	: 62.34 lakh tonnes
4.	Total quantity of topsoil utilised	: 22.77 lakh tonnes
5.	Percentage of utilisation of topsoil	: 36

III	Management of Sub-grade Mineral (in tonnes)	
1.	Total quantity of sub-grade mineral generated	: 424962
2.	Total quantity of sub-grade mineral stored	: 424962
3.	Total percentage of sub-grade mineral stored	: 00.00
4.	Total quantity of sub-grade mineral utilised	: 424962
5.	Total percentage of utilisation of sub-grade mineral	: 100
IV	Management of Waste	
1.	Quantity of waste generated	: 388 lakh tonnes
2.	Quantity of waste stored	: 301.24 lakh tonnes
3.	Percentage of waste stored	: 77
4.	Area occupied under dumps	: 34.02 ha

In several mines, systematic benches of proper height and width have been developed. Haul roads to pit bottom with soft gradient have also been developed. In one of the mines, haul road has been reconstructed as pucca cement road to improve the transport and reduce pollution due to dust.

#### *Udaipur Regional Office*

MEMC week was celebrated in Udaipur Regional Office for the third time in succession. Mining activity in Rajasthan have come under the Hon'ble Supreme Court scanner on a number of occasions in the past. The recent order of the Apex Court delivered on 30-10-2002 banning all kinds of mining activities in the Aravalli region also establishes the need for adoption of eco-friendly mining in the region.

There has been spontaneous response from about 37 mines of this region for their entire participation in the week-long celebrations. This celebration creates awareness towards protection of environment and conservation of finite mineral resources of this region. Most of the adverse environmental impacts in this area have been minimised through selection of appropriate technology for pollution control and protection of eco-system.

#### **16.5 FIMI ENVIRONMENTAL AWARDS**

FIMI has instituted Environment Awards to encourage preservation and improvement of environment and ecology in the mining areas and to promote a healthy competition among them in this regard. The following awards (a shield to the management and a citation to the environment manager at the mines identified by the management) are given to each of the mines adjudged best for its efforts to promote integration of environmental concerns in their mining plans

1.	Abheraj Baldota Environment Award	:	Fully Mechanised Mine
2.	Gem Granites Environment Award	:	Fully Mechanised Mine
3.	Mistrilal Jain Environment Award	:	Semi-Mechanised Mine
4.	Subh Karan Sarawagi Environment Award	:	Manual Mine

A Committee consisting of experts from MOEF, IBM and the mining industry assess the environmental performance of mines and selects the best in each category. The performance (i.e. marks obtained) by the mines in the MEMCW celebrations organised by the IBM as well as assessment of work done by the committee constituted by FIMI for the purpose forms the basis of selection. A questionnaire is circulated among all mine managements each year with a request to return the same duly completed to the FIMI for consideration for these awards.

#### **16.6 ECO TASK FORCE**

The ECO Task Force was constituted by the MOEF as 127 Infantry Battalion of the Territorial Army. At present there are two companies with 247 personnel of various ranks as detailed below :

(a)	Officers	-	4
(b)	JCOs	-	7
(c)	NCOs	-	7
(d)	Other ranks	-	229

The main tasks assigned to the force are :

1. Rehabilitation of mined out areas of Doon Valley
2. Soil Conservation in the Valley
3. Afforestation in mined out areas as well as surrounding areas

The Force commenced rehabilitation work in 1985 and till September 1993, it had completed rehabilitation work for 25 mines. Afforestation work done by the force included digging of pits for plantation (26 lakhs) collection and plantation of saplings (26 lakhs), shrubs, creepers and grass weeding of saplings, watering of plants, erection of new fencing, construction of terraces for plantation, collection of humus, etc. Soil conservation work done included construction and repair of check dams and retaining walls, collection of boulder stone, construction and repair of ballie crates, etc. It has also raised 3 nurseries.

During the year 1993-94 (up to September, 1993), 4,64,525 saplings have been planted by the Force covering an area of 400 ha. The number of check dams constructed was 508.

#### **16.7 CENTRE OF MINING ENVIRONMENT**

The Centre of Mining Environment was established at Indian School of Mines, Dhanbad, under the sponsorship of the Ministry of Environment and Forests, Government of India, in April 1987 under its scheme of setting up centres of excellence on environmental matters. The main objective of the centre is to provide trained manpower for the mining industry in the field of environmental protection in mining areas and to carry out research and consultancy work in the field of environmental protection. Since its inception, the centre is offering a 3 semester M. Tech programme in Environmental Science and Engineering and has also conducted some twenty short

courses for training of service personnel from the mining and allied industries and Government Departments.

#### **16.8 OTHER INSTITUTIONS IN THE FIELD OF ENVIRONMENTAL EDUCATION, RESEARCH AND TRAINING**

- National Environmental Engineering Research Institute, Nagpur, a national laboratory under the CSIR is a premier institute in the field of environmental studies and research work and training.
- Central Mining Research Station, Dhanbad, another CSIR laboratory, carries out mining research work highlighting the various issues related to the environmental degradations associated with the mining activities in both underground and opencast mines.
- The Environmental Geology Division of Geological Survey of India also concentrate on the environmental aspects of mining and industrial areas, urban and regional geo-environmental aspects and prepares thematic maps highlighting the environmental resources, hazards and preventive measures.
- Tata Energy Research Institute, New Delhi has set up collaborative programme of network research which investigates environmental management in mineral producing countries.
- Other institutions imparting formal environmental education include Jawaharlal Nehru University, New Delhi; Earth Resources Centre, Indian Institute of Technology, Bombay; Earth Resource Centre, Trivandrum and a number of Indian Universities where post graduate courses are also offered.