9.0 Environment

To achieve sustainable development, the growth of industries and protection and repair of environment must run parallel. Mining is one of the activities which are not friendly to environment. It assumes more importance in India for the reason that its growth rate is more than that of GDP (1992-93 base) and mining of iron ore is one of the major activities of the mineral industry in the country where clusters of iron ore mines co-exist. Bihar/Orissa, Madhya Pradesh, Karnataka and Goa are important States where iron ore is being mined by opencast method which causes more harm to the environment than that done by underground method of mining. In these regions, there are about 250 mines covering an area of about 9,500 hectares. Environmental problems of all these regions are of similar in nature, but in Goa, there is an additional environmental pollution, i.e. siltation. Environmental pollutions in these areas and their mitigatory measures practised and/or should have been practised are discussed in this Chapter.

9.1 GOA

The State Goa has an area of 3,65,400 hectares (ha) of which about 65,000 ha has been leased out, but only 18,000 ha is currently under mining operation (1991 base). Though manganese, silica and other minor minerals are being mined in this area, these activities are insignificant compared to iron ore mining. So, the environmental damage caused by the mining activity is practically attributed to operation of iron ore mines. Further, high ore to overburden ratio has aggravated the damage to the environment as present mining of 14 million tonnes ore needs removal and disposal of 40-50 million tonnes of waste per year in addition to existing but disposed waste of the order of 400 million tonnes in North Goa alone.

Huge quantity of existing waste and further addition every year, undulating topography and high incidence of rainfall (3800 mm yearly) are important contributing factors of dump wash off and siltation of low lying fields and high turbidity of stream water in rainy season. Also, tributaries and nallah draughts get reduced and sometimes hamper navigation. In 1992, it was estimated by officers of IBM that about 75 hectares of agriculture lands was engulfed by thick silts of 0.6 to 1m in North Goa alone.

Dust concentration, suspended particulate matters (SPM) in ambient air is, in most of the cases, well within the permissible limit (500 $\mu g/m^3$, industrial area) in the areas where actual mining operations are carried out though in a few cases, SPM is as high as 1648 $\mu g/m^3$ of air. But the dust fall rate in residential areas is high and sometimes causes public irritations specially in villages like Velguem, Surla and Pale. For want of any threshold limit value (TLV) for dust fall rate, it is difficult to impress upon the mine operators/transporters for its control. But they are well aware of the adverse effect of dust generated due to different activities related to mining. Sometimes they get the SPM in ambient mine air sampled and analysed by National Institute of Miners' Health (NIMH), KGF. Further, they deploy water tankers for sprinkling water on haul roads and other important roads/points in and around the mines.

Some samples of water used for drinking purpose show that they are not fit for human consumption either due to high turbidity and

offensive colour or bacteriological reasons. In general, total suspended solids in the water samples, especially in rainy season, are normally more than the limit specified.

Goa is prone to siltation of agriculture fields, nallahs, river beds and creeks due to wash-off from dumps in rainy season. In north Goa, certain agriculture lands are found covered by silt. About 75 ha of lands in this area is affected due to siltation having thickness from 0.6 to 1m. Most of the affected lands are found in villages like Nawarwada, Devarwada, Gauthana and Pissurlem, and some nallahs are also found affected by siltation, viz. Kudnem, Valvota and Sonshi. The rivulet "Valvota" is being used for navigation by M/s Sesa Goa Ltd. for transhipment of iron ore to Marmagaon port and the Company occasionally resorted to dredging some stretches of this rivulet as draught gets reduced due to siltation. The main river of Goa, "Mandovi" also suffers from the same and requires similar treatment sometimes. It is the siltation due to which loss of crops in agricultural fields, reduction of fish population in streams and navigation difficulties take place in this area.

Mine operators have also taken a number of measures for controlling, wash-off from dumps and siltation. In some cases, check dams and water filter beds at the higher contours have been constructed/erected to prevent suspended solids from reaching water bodies and agriculture lands. Laterite walls at the toes of the waste dumps are also maintained to prevent fine particles and slime from being washed out during the monsoon. Tailing ponds to treat tailings from the beneficiation plant are constructed in all cases and are also being properly maintained.

Ground vibration in this area is limited as drilling/blasting is normally not practised for mining ores. Noise levels in mines mostly are within the permissible limit prescribed by Directorate General of Mines Safety (DGMS), but to the nearby residents, especially those who are living besides the roads, these are high, specially in the night due to the use of trucks/dumpers for ore transportation.

9.1.1 Afforestation

Satellite imagery over the period 1981-89 in Goa region revealed that the increase in mining and built-up lands during this period was at the expense of vegetation cover and crop lands. Table 9.1 indicates the change in land use in a mining area in Goa over the 8-year period. The data show that about 11.2 km^2 agriculture land was engulfed by iron ore mining. (1)

TABLE 9.1 :AERIAL EXTENT OF CHANGES IN LAND USED AND LAND COVER FEATURE IN THE MAIN MINING AREA OF GOA

(in km^2)

Data used	Mine area	Crop land	Fallow land
MSS-81	19.6	101.4	35.8
MSS-84	36.6	95.0	34.2
TM-87	54.9	84.8	46.9
SPOT-89	77.2	90.2	40.8
Changes in 8 yrs	(+)57.6	(-)11.2	(+)4.9
% change/yr.	5.8	1.1	0.5

Source : Centre for Resource Engineering, Environmental Impact of Iron Ore Mining in Goa. Final Report submitted to the Ministry of Environment by IIT, Bombay, April 1992.

Afforestation is the main stay in reclaming mined out areas in Goa. However, in a few cases, pits are used as water reservoir and in one case for pisciculture. Till 1983, only about 50 ha leased area including waste dumps was covered by plantation and up to the year 1993, it was estimated that over 200 ha land was under green cover in North Goa itself. Now mine operators/owners are conscious about the environment and are planting saplings of different species like Acacia, Caesareana, Soobabul, Neem, etc. Old tailing ponds are also being afforested.

9.2 KARNATAKA

In this State, there are two important areas where iron ore mining is being carried out since long. These areas are Kudremukh and Bellary-Hospet. Kudremukh is the centre of single largest iron ore mining in India, where rainfall is very high. On the other hand, Bellary-Hospet belt is in the semi-arid zone

where dust (suspended particulate matters, SPM) concentration is the main environmental problem. These two iron ore mining areas are discussed separately.

9.2.1 Kudremukh

9.2.1.1 Background Information

The topography of this area is hilly, except the valley portion through which the river, Bhadra flows. Annual rainfall in this region is 6,000-7,000 mm mostly received from southwest monsoon during the period June-September. The temperature during summer goes as high as 36°C and in winter it sometimes dips below 4°C, and the corresponding humidity varies between 100 and 43%.

Kudremukh Iron Ore Company Limited (KIOCL) acquired an lease area of 4,542 ha consisting of :

Forest land	:	1,416 ha
Govt. land	:	3,018 ha
Private land	:	108 ha

The mining activity is confined to an area having length 5 km and width 1 km only. The topmost bench is at 1,284 mRL and the mining activity may go up to 882 mRL. At the very outset of mining operations, KIOCL adopted some measures to prevent different pollutions caused by its activities and the same are summarised below :

POLLUTION CONTROL AT KIOCL PROJECT

Water	Solids	Noise	Air
Treatment plants	Dams Lakya Dam Mini dams - 2 Nos. Garland drains on mine slopes Dump pond Dump sump	Exclusive planting trees, use of ear plug by workers, good maintenance of equipments	Suppression of dust in mine roads by regular sprinkling of water by deploying 28,000 litre high pressure sprinklers. Barrier of trees planting wet scrubbers and high level chimney in Mangalore plant.

As no chemicals are being used in the beneficiation process, no pollution takes place on this account. Further, most of the water used in processing plant is recycled. Hence, effluent quantity is negligible. The make-up of water is drawn from Lakya Dam by a gravity system. However, the industrial and domestic effluents are treated in separate plants. At most of the time, there is no discharge of effluent from the plant. However, a submarine pipeline is laid into the sea up to 50 m from the low tide line to dispose the excess water into the sea. Further, periodical monitoring of coastal water as well as the effluent being done with the assistance of Fisheries College, Mangalore.

9.2.1.2 Solid Waste Management

Generation of solid waste in the mine is limited. However, two pockets were identified for the disposal of waste as and when encountered.

The tailing generated after beneficiation of ore is disposed into a big dam (Lakya Dam) located at a distance of about 2.5 km from the concentrator. The tailings contain 60% water and 40% solid. The tailings when dumped into the reservoir, suspended particles get settled down on the bed and cleaner water flows towards the spillway which is also meant for surplus discharge in monsoon. Tailings disposed into the reservoir till now are over 50 million tonnes.

To arrest the flow of mine run-off into the main river, two dams have been constructed with rockfills which filter out the water and retain the silt which is reclaimed periodically. Diversion channel was also constructed to divert the clear water to the main river Bhadra by passing original river course to prevent the pollution of water.

Facility also exists in the plant system to contain the solid in a big pond in the event of power failure. The capacity of the pond is 35,000 m^3 and at the nearby place, another pond also exists for desilting alternately.

9.2.1.3 Noise Pollution

The noise level is being regularly monitored. Further, location of the mine and the concentrator has been so planned that the noise generated would get attenuated to an acceptable level by the time it traverses to the township and for this purpose, thick barriers of trees have been raised for reducing the noise level.

9.2.1.4 Afforestation

Kudremukh area has vast grassland and the hills are devoid of any thick vegetation. However, some vegetation exists in the valleys where soil is rich in humus. As the rainfall is high, chances of erosion of land are also high, specially in excavation and earth-fill areas. To have good canopy of trees, undergrowths were removed. Further, agriculture land in the leasehold area was developed for cultivation of two-tier crops. At the time of construction of the mining projects, hardly any tree was felled as the area was practically devoid of any good vegetation. However, KIOCL management took up intensive measures for the tree plantation in the project area. On all important earth-fill areas and on side barms, turfing has been done on large scale to prevent erosion and slips of earth.

For the first three years of the project, KIOCL earmarked Rs.10.7 million for carrying out various activities like -

i) Development of nurseries.
ii) Afforestation on the orebody where immediate mining operation not contemplated.
iii) Development of orchards.
iv) Development of sholas.
v) Plantation in township along avenues and parks.
vi) Development of gardens around public building.
vii) Plantation in field slopes and river valleys to prevent soil erosion.
viii) Development of fisheries, poultry, vegetables farms, etc.

Nearly 5.7 million saplings were planted till 1988-89 but the survival rate was only 46%. About 4,08,000 agaves were planted on sensitive contours of the mine slopes covering a total length of 54 km. This practice helped to arrest soil/waste on the western face of the orebody and restricted pollution of "Kochige Hole" which is a tributary to Bhadra river. Similar contour planting was also done in dumps I & II. The green belt of these contours was about 12 m wide.

The development of green belts is not only serving the purposes of aesthetic and arresting soil erosion but also actively filtering dust and noise.

9.2.2 Bellary-Hospet Sector

Topography of the area consists of hillocks, mainly close to Bellary, around Hospet and in Sandur valley which itself runs over a length of 40 km with a width of about 10 km. In this area, there are 116 leases with only 60 important mines currently in operation, covering about 16,000 ha where mining operations by opencast method are carried out for last 30 years. Mainly due to unscientific practice, overall environment was damaged considerably, especially till late 70s. The semi-arid climatic condition (rainfall below 750 mm) has further worsened the situation. However, now many companies including National Mineral Development Corporation Ltd. (NMDC) and M/s Sandur Manganese & Iron Ore Company Limited are conscious of environment and are taking due care for protection and repair of damaged environment.

Dust (suspended particulate matter SPM) is the main pollutant in this area. It exists almost throughout the year as rainfall is less in this region. Deforestation and siltation of dams/tanks are other sides of the pollution in this mining belt.

Plantation is the main practice for protection of environment and NMDC, the leader among all mine owners in the region, is also following the same suit. The Company so far planted 4 lakh saplings of 45 species in Donimalai Hill Top, plant areas, township and below the tailing dams area and, over a period of 20 years they are now fully grown and have brought about change in climate with improved rainfall in Donimalai area. The overall micro-climate condition has become cooler even during summer though the area falls under semi-arid zone having precipitation of 700 mm. M/s Sandur Manganese & Iron Company Limited have also put in special efforts during last six years and have planted more than 3 lakh saplings in their Deogiri, Sabbarayan Halli Manganese & Iron Ore Mines area which has brought "green view".

Most of the small individual mines producing less than 1 lakh tonnes of saleable iron ores per annum are unable to obtain required species in sufficient quantity in time during the onset of monsoon from local forest department. It would be a good idea to encourage these small mine owners to form a cooperative among themselves for maintaining common nurseries at convenient places like Sandur, Hospet, Toranagallu and Bellary. It can be mentioned here that many mine owners have made special efforts for practicing tree plantation in and around their leases. But maintaining/raising plants at these mines is difficult as iron ore in this region occurs on top of hills which are at much higher levels than those of water tables. So water required for growing trees at hill tops for dust suppression or wet drilling has to be brought from long distances even 20 km. This constrain affects the profit margin.

Handling of tailings is the major and expensive issue for protection of environment, and it can be effectively contained only by financially sound company like NMDC which has spent about one crore rupees for construction of a tailings dam at Donimalai. So far, there has been no overflow from this dam which results in percolation of water, thereby water table of the area has risen considerably benefiting the farmers residing in neighbouring villages, namely Narsapura, Ranjitpura and Navalatti. The NMDC has also constructed six check dams both on the eastern and western flanks of Donimalai iron ore deposits for allowing clear water to feed nallahs/streams originating from these hills. Further check dams at the eastern side, constructed in South and North Blocks of Donimalai have benefited the people living in nearby villages.

When market was depressed some 6-7 years back, there was practically no sale of iron ore fines which resulted in dumping of fines with waste. This practice not only caused environmental problem, but also good quality iron ore fines were lost permanently. However, this practice does not exist now. But still there are some private mine operators who have been indiscriminately dumping the waste rocks from hill tops all along their lease boundaries resulting in irrepairable damage to the forest wealth at the lower levels and foot of the hills. But some private mine operators have taken few good preventive measures against solid waste by constructing gabion wall structures, check dams along the streams/nallahs in their areas.

It has been reported that siltation is taking place in Tungabhadra Dam, Narihalla Dam and in Rajapura Daroji taluks due to various human activities including mining operations being presently carried out in 60 odd mines. Further, it has been reported that mine operators in Hospet area are taking better measures for the protection of environment than the mine operators in Bellary area wherein only 10 important iron ore mines exist against 30 in and around Hospet town.

It is the fact that some private mine operators are not able to practice wet drilling for want of easy availability of water at hill tops. In Sandur sector, some mine operators have selected dump sites which have resulted in big damage to forest wealth.

9.3 MADHYA PRADESH (BAILADILA)

The area consists of a prominent hill range of about 40 km long and about 10 km wide with highest peak at 1,276 m above MSL, and lower rolling planes of elevation varying from 300 to 400 m with occasional hills rising up to 600 m above MSL. The entire area is practically surrounded by forest; in fact the area itself is in the forest land.

There are 14 important deposits in this area and out of these deposits, presently, Deposit-14, 11C and 5 are being mined and Deposits 11B and 10/11A are proposed to be taken up. Present production level is 15.5 million tonnes per year.

The eastern slope of the area is drained through the streams which flow towards north-east to Sankani River. Drainage between the eastern and western ridges is through two streams flowing in opposite directions, viz. Galli nallah towards south and Sankani nallah towards north and their division point exists near Deposit-14. Sankani nallah cuts across the eastern ridge near Jhirka village and flows down

east and north-east and becomes the river "Sankani". This river further joins Dankani river near Dantewada to become Dantewada River which ultimately flows west and joins Indravati River.

The western slope of the area is drained by "Mari Nadi", "Burudi Nadi" and other small streams, all of which meet River Indravati at different points. Finally, Godavari River is fed by the latter near Bhopalpatrian. Southern part of the area is drained through "Malinger Nadi" joining Sabori river and Galli nallah to Talperu river, all again flow into the Godavari River. Drainage density is found to be 2.35 for this region which is low compared to heavy rainfall (2600 mm) regions. As the formation is hard, erodibility of land mass is less, but due to structural reason, infiltration of precipitation is good thereby ground remains as a major source for perennial streams.

Type of the forest in this region falls close to class 5A (Southern tropical dry deciduous type) and certain patches represent class 5B (Northen tropical dry deciduous type). The Bailadila Forest is fairly widespread and dense supported by good rainfall and is rich in flora and fauna. The hill tops, however, are barren due to rocky outcrops and lack of soil, but supports only scrabs, grasses and stunted trees.

Temperature of the region is moderate with annual average day temperature ranging between 24 and 35°C and that of night between 11 and 17°C. However, during summer, the mercury goes up to 40° C. The average rainfall is 2,660 mm, with 85 percent rainfall between July and September. The range of predominent wind velocity is 19-20 kmph blowing from SW and NE.

Different lease areas of this belt are being used for pit excavation, approach and haul road making, waste dumping, construction of ore processing and loading plant, stockpiles, residential and functional housing and tailings dam. About 400 ha out of 954 ha of mining lease (ML) areas of Deposit-14 and 459 ha out of 672 ha of ML area of Deposit-5 have been utilized for the above mentioned purpose. Fortunately, the areas thus affected were mostly barren hill tops or forest blanks and parts of less vegetated areas. The dense forest areas are not affected except for small portion covered by waste debris which have flown down.

The census data and revenue record of the buffer zone area show an increase in the total forest land from 14.3 to 20.5 percent between 1971 and 1981 due to regrouping of lands, and not due to actual increase. Interpretation of satellite data generated during 1985 and 1991 has revealed that dense forest area remains the same at 12.5 percent, degraded and less dense forests decreased from 17.6 to 14.3 percent. Land use due to mining and other activities has increased from 2.2 to 3.8 percent. But crop land also increased from 3.9 to 5.1 percent but built-up area remained unchanged at 0.8 percent during the same period. However, small areas in dense forest destroyed by waste dumping have been compensated by afforestation in the slope and around township areas. Now, new mines are coming up at Deposit 10/11A and 11B which will, respectively, affect 391 ha and 75 ha lands over the hill tops which are either barren or grasslands. Apart from these lands likely to be affected, 82 ha and 27 ha will be affected, respectively, for other facilities in the less dense forest on down slope area.

For disposal of waste dump, sites are selected considering topography of the area in order to restrict the flow of materials into natural water course, and for this purpose, areas where closed valleys and/or blind angles exist, have been proposed with the provision of rock toes. Flat tops and inward slope area, construction of small terraces with peripherial bands for dumps and their stabilization by planting agave, shrubs, grasses and fast growing trees on terraces are the important measures to be taken up for environment-friendly disposal of waste. The reclamation of old waste dump of Deposit-14 has been started.

It has been observed from the recording made over last 20 years at the station set-up at Deposit-14 that there is practically no change in climatic condition except for cyclic heavy rain once in every 4 or 5 years.

To study the ambient air quality, a network of 18 stations distributed over work zone, residential areas and buffer zone has been established for collection of data during three important seasons. The suspended particulate matter (SPM) has been found to vary from 200 to 290 $\mu g/m^3$ air, but in buffer zone 100-170 $\mu g/m^3$. It is however, well within the TLV of 500 $\mu g/m^3$ for industrial zone. The levels of SO_2, NOX, CO, lead, etc. are below detection limits. To control pollution from dust, wet drilling, water sprinkling at mine and haul roads, and green belts around loading points are being practiced for effective control of SPM. The respirable dust level recorded in the work zone has been found to be 2.89 $\mu g/m^3$ with 1 percent silica which is far below the general limit of 5 $\mu g/m.^3$ In addition to this practice, it has been proposed to mist spray the conveyor transfer point, storage bins for fine ore, etc. for new mines. It has been envisaged that the overall ambient air quality is and will remain well within the limits prescribed for both industrial and residential zones.

Monitoring of water quality was done at 38 strategic locations like discharge points of screening plant and mines, workshops, loading yard, tailings dam, the source location of waters for industrial and domestic consumption and streams carrying the resultant loads at downstreams and of projects. The monitoring has revealed that the actual pollutants in water are suspended solids. But dissolved solid level remains unaltered and is quite low, around 21-124 µg/litre. Now several control measures are adopted and it has been observed that all the parameters of water are well within the prescribed limits at final discharge points. However, the reddish colour of water still persists at the Sankani nadi. Added to this, extensive mining of colluvial deposit are of cassitarite and their panning in this river and its tributaries are causing turbidity.

In buffer and core zones, noise levels are quite acceptable as have been revealed from data collected from 17 points over a period.

To assess the regeneration potential of top soils and its necessary amendments in the event of finding deficiency in nutrient levels, NMDC is doing regular monitoring of soil quality for which 14 locations were selected. These studies are being conducted. It has been observed that the top soil of this area has good texture capable of holding sufficient water and satisfactory moisture content. But the top soil as well as waste dumps is a little acidic showing pH-values ranging from 5 to 6.

The area has enough surface/stream and groundwater. Considering expansion of mining activities including proposed slurry transportation of iron ores to Vizag, different streams will have sufficient water for the use of villagers residing downstream.

The entire ecosystem of this region has been studied by various agencies with special emphasis on distribution pattern and diversity of species, their interdependence and regeneration potentiality. It has been revealed from the study that major stream and water courses do not indicate any detrimental contaminations as far as aquatic life is concerned.

In and around free areas, residential colonies, lower slope of main hills, on barren hillocks around loading plants and on waste dumps, massive afforestation has been undertaken since long. Now due to green foliage, aesthetics in and around colonies and other areas has improved considerably. Further experimental plantation done on iron ore tailings has given encouraging results. The survival rate of these plants is also very good.

Thickness of top soil varies from place to place. At the tops and slopes of hills, thickness of top soil is negligible but at the foot of hills and nearby villages, it is up to one metre. The NMDC has decided to preserve and utilize top soils which would be available from new mining area or from expansion of existing mines.

Due to the mining activity, this area, predominently inhabited by tribal people, is exposed to urbanization, thereby education, health, employment and overall quality of their living standard have considerably improved.

9.4 BIHAR-ORISSA SECTOR

More than one-third (21 Mt) of iron ore production of India comes from Eastern Region, i.e. Bihar-Orissa belt. So, it is a very important sector of iron ore mining in India. There are about 121 working mines having total lease area of 45,637 ha, of which over 7,610 ha (16.7%) of lands has been degraded due to mining and other related activities. But only 337 ha has been covered under afforestation which accounts for about 4.5% of the total degraded lands.

9.4.1 Bihar

There are 33 important working iron ore mines in this State; incidentally all fall in Singhbhum district, which accounts for about 33% of the iron ore produced in this region. Bihar has 3,092 ha degraded lands constituting 21% of the total iron ore lease area in this State. Some 138 ha (4.5% of the degraded lands) was covered by afforestation (See Table 9.2).

9.4.2 Orissa

In this State, there are 88 working mines, all situated only in three districts, viz. Keonjhar, Sundergarh and Mayurbhanj, covering 30,939 ha of lease areas of which 4,519 ha (14.6%) was degraded, but 199 ha (4.4% of degraded lands) was reclaimed by way of afforestation (See Table 9.2).

9.4.3 Reclamation

9.4.3.1 Afforestation

In this region, Afforestation of land is the main means of reclamation of degraded lands or of improvement of land uses. Only about 4.5% of the degraded lands was under afforestation. In Bihar, about 631,000 saplings were planted over an area of 138 ha of degraded lands where survival rate varies from 30-85% (average 55%). In Orissa, about 284,000 saplings were planted over an area of 199 ha. where survival rate was found to be between 25 and 85% (average 54%) (See Table 9.2).

In this region, various species were planted important ones are Eucalyptus, Neem, Seris, Gulmohar, Jamun, Mango, Teak, Karanj, Gehmar, Accasia, Sal, Sisam, Charkunda, Jackfruit and Deodar.

9.4.3.2 Backfilling

As almost all the iron ore mines in this region are active, and many of them are along the slope of the hills and mounds, reclamation by backfilling is practically not possible. In view of this, the mined-out areas are mostly reclaimed by means of afforestation.

9.4.4 A Case Study

The mine is situated in West Singhbhum district of Bihar and is one of the oldest and

TABLE 9.2 DEGRADATION OF LANDS AND THEIR RECLAMATION

(in ha)

	No.ML	ML area	Mining	Dumping	Others	Total	%Degradation	Afforestation	Survival rate %
ORISSA									
Keonjhar	50	19573	1816	335	457	2608	13	119	54
Sundergarh	23	5714	235	76	414	730	13	79	55
Mayurbhanj	15	5352	648	464	69	1181	22	1	30
TOTAL	88	30939	2699	875	940	4519	14.6*	199 (4.4)	54*
BIHAR									
Singhbhum	33	14698	1705	696	691	3092	21 *	138 (4.5)	55* 54.4@
GRAND TOTAL	121	45637	4404	1571	1630	7611	16.7@	337	

* Weighted average, @ overall average.

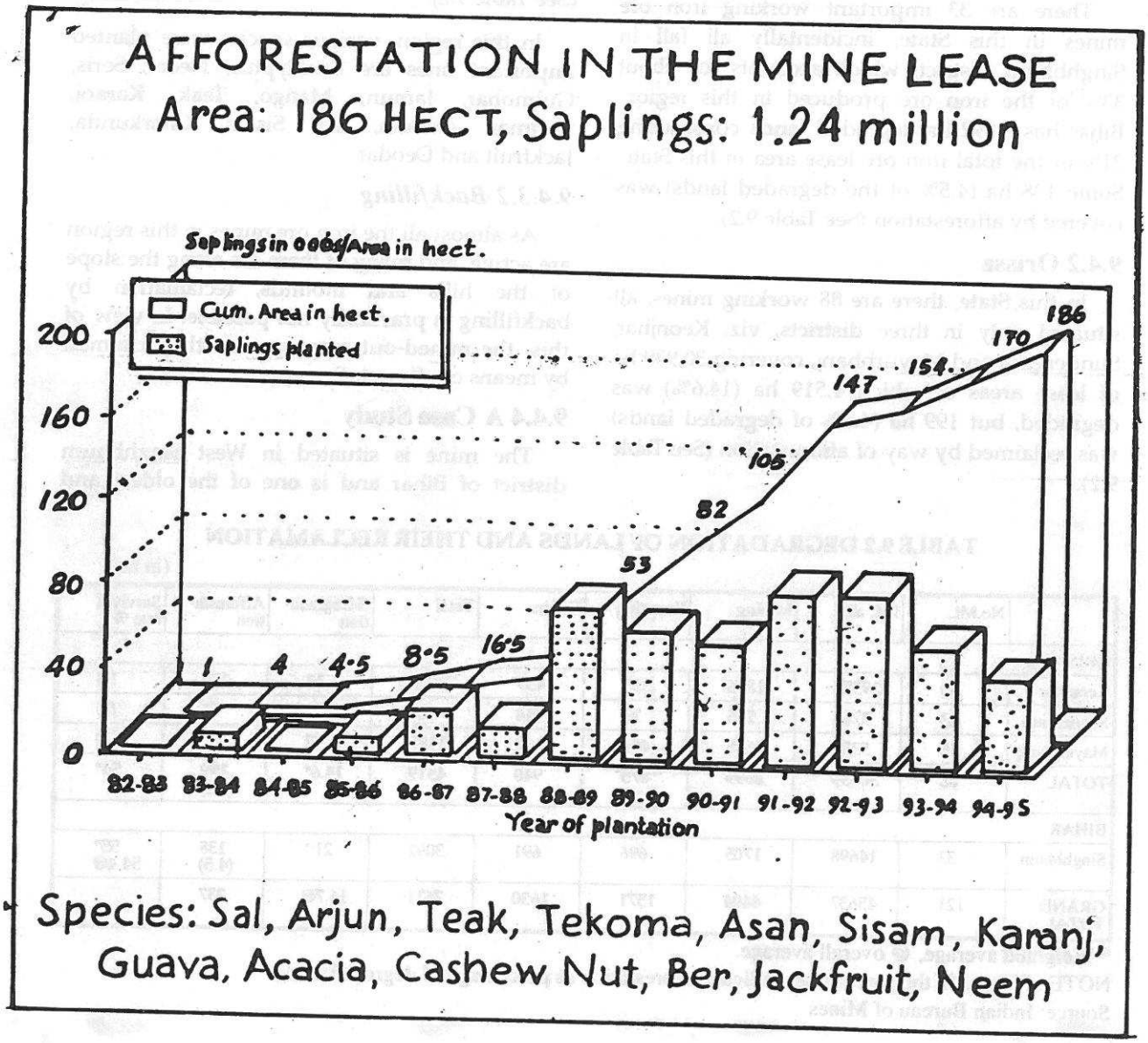
NOTE : Figures in the parentheses indicate afforestation as percentage of degraded lands.

Source: Indian Bureau of Mines

largest opencast iron ore mines in the country. It became operational since 1925. The mining had grown from à primitive manual to semi-mechanised operation over last several decades and in 1967, a complete mechanised mine was commissioned with integrated facilities for crushing, screening, washing, conveying and wagon loading, and equipment and laboratory for pollution control measures.

Total lease area of the iron mine is 1,160.60 ha of which 762.43 ha is forest land. Reserves as on 1.1.1994 are 167 million tonnes and the life of the mine is expected to be around 34 years.

In more than sixty years of intensive mining, only 33 percent of the forest areas has been disturbed whereas 80 percent of the non-forest land was utilised. The continuous efforts have resulted in vegetation cover as Remote-Sensing Imagery indicated 70 percent dense forest cover in the core zone of 3 km radius. When some of the worked-out areas are abandoned after extraction of ore, immediate reclamation is taken up. Over the last decade, more than 10 lakh saplings have been planted and the survival rate has been found to be more than 85 percent. Afforestation till 1994-95 in the lease area has been detailed in the Figure 9.1.



The mine has a well-managed nursery which provides varieties of saplings (timber, fruit, ornamental and avenue types) for reclamation of mining areas. Budgetory provision for reclamation programme by afforestation at this mine is about Rs. 1.5 lakhs per annum and for horticulture activity about Rs. 10 lakh r.o.m. Average expenditure on environment is Rs. 2.5 per tonne of r.o.m. Commendable research activities on environment are carried out with a well-equipped laboratory. Other areas include regular checks on pollution control systems, testing of drinking water round the year, data logging of meteorlogical parameters and monitoring of noise and respirable dust.

Air quality is being monitored at four stations in three seasons and an average of three years data of Suspended Particulate Matter (SPM) in micrograms per cu m is presented here (Table 9.3). The prescribed limit is 500 micrograms per cu m, but maximum SPM found is 325 $\mu g/m^3$ of air.

TABLE 9.3 : AIR QUALITY

Station	Post-monsoon	Monsoon	Summer
Mining Face	202.34	325.56	300.86
GMs Office	86.22	123.50	98.73
Township	88.23	132.25	135.67
Korta Spring	78.49	93.87	98.42

Domestic discharges are also regularly monitored and they are found to be within the prescribed limit. Details have been given in Table 9.4.

TABLE 9.4 : DOMESTIC DISCHARGE

(Water quality data-average of three years)

Parameter	Monsoon	Post-monsoon	Winter	Summer
pH	7.3	7.4	7.7	7.3
TSS(mg/l)	98	72	47	5.8
DO(mg/l)	7.9	7.1	8.0	8.6
Iron(mg/l)	0.1	0.3	0.2	0.2

Effluents of industrial activities are being monitored during all four seasons. Data for the year 1995-96 have been furnished in Table 9.5.

Likewise data on noise pollution are also being generalised for monitoring purpose in both silence zone and mining areas, and these are found to be within the permissible limits.

TABLE 9.5 : TRADE EFFLUENTS

Parameter	Monsoon	Post-monsoon	Winter	Summer
pH	7.8	7.8	7.3	7.6
TSS(mg/l)	125.0	88.0	78.0	8.2
DO(mg/l)	7.4	6.9	7.5	6.7
Iron(mg/l)	0.9	0.8	0.3	0.2

Data for the year 1995-96 have been furnished in the Tables 9.6(A) & 9.6(B).

TABLE 9.6 (A) : NOISE LEVELS IN SILENCE ZONE

Zone	Day time (8.30 a.m.)	Night (7.30 p.m.)
Hospital & Schools	42.14	3.8
Township	40.28	38.67

TABLE 9.6 (B) : AMBIENT NOISE LEVELS AROUND THE MINING WORK ZONE AREA

Morning shift	Second shift	Third shift
48.50	45.17	38.75

Note : Noise levels in dB(A) (30 minutes Leq.)

All employees of the mine undergo a regular periodic medical examination at the Occupational Health Centre Laboratory which is a statutory requirement. There is a systematic follow-up and since 1988 about 1,200 employees were covered under this programme. The data are computerised and analysed to find abnormality, if any.

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