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Impacts of Gypsum Mining on Environment in Bikaner

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ABSTRACT: Gypsum is one of the principal mineral mined by opencast mining method in Bikaner. Gypsum/Gypsite deposits cover 60% of Bikaner's total area. Earthy variety of gypsum called gypsite is the main variety in the area. Gypsum is an important industrial mineral. The environmental impact assessment of Gypsum Mining and their associated activities in Bikaner follows identification and quantification of impacts. The impact of gypsum mining in the study area has been slightly negative. On the other side mining of gypsum increased the fertility of the soil and porosity of the soil. Total Impact Score (TIS) indicates that there is an appreciable impact on environment; but not injurious in general. Mitigation measures have been required to reduce these negative impacts of gypsum mining.

I.INTRODUCTION

Bikaner is located in North-Western part of Rajasthan and forms a part of the 'the great Indian Thar desert'. Most of the areas of the district are covered with sand and sandy alluvium. The deposits of gypsum are shallow and scattered over large areas. Most of the land is owned by private cultivators. Gypsum is one of the principal mineral mined in Bikaner. Generally, the mining of gypsum has been carried out from open cast methods. This is associated with the problems of disposal of top soil cover, low grade materials and large pits left behind after excavation. Mineral based industries like cement plants and grinding plants have the problem of suspended fine materials in the atmosphere, which creates health hazard, degradation and retardation of plant growth and causes hydrological problem⁸⁸ (Saxena,S.K., 2000).

Gypsum Resources

Gypsum/Gypsite deposits cover 60% of Bikaner's 28,466 km² area. Gypsites are thick to thin in 6 of 8 Tehsils. Bikaner, Pugal, Miranwala, Lunkaransar, Chattargarh, and NW Kolayat are the prominent tehsils. Gypsum mining is confined to the northern and north-western parts of Bikaner district viz. Lunkaransar, Chattargarh, Pugal and Khajuwala tehsil. There are 36 leases covering 4825 sq km area in Bikaner in the year 2020-21. Gypsum is not a very significant employment generator mineral in Bikaner. The maximum employment provided by gypsum was 650 persons in the year 2011-12, which is reduced to 220 in the year 2020-21.

Significance of Gypsum

Gypsum is an important industrial mineral. It is used as a retarder in cement, as a fertilizer, as a filler in various materials such as paper, crayons paint, rubber etc. and in the manufacture of plaster of paris. Calcined Gypsum is extensively employed in the building trade, for the production of various types of plaster, sheets and boards for stucco work. It is also used in polishing beds in the manufacture of plate glass, and as an adulterant of foods.

Environmental Impact Assessment Methodology

Environmental Impact Assessment has been done with the help of Leopold Matrix Procedure of Evaluating Environmental Impact⁸⁹ (Leopold, L.B. et al., 1971). It is a semi quantitative graded matrix to assess the overall impact of mining and related activities on environment. Matrix method basically incorporates a list of project activities in row and environmental parameters in column. Impact assessment is weighted from total impact score on a scale as given in Table 1.



The impact values were assigned as per scheme shown below:

Table: 1:Scheme of Assigning Impact Value

Impact Value	Impact Nature	Remarks
0	No impact	+ sign denotes beneficial impact - sign denotes adverse impact
1	Slight impact	
2	Appreciable impact	
3	Significant impact	
4	Major impact	
5	Severe / Permanent impact	

Impact value of each parameter was multiplied by the weightage values allotted to the corresponding parameter. This gave final score in terms of environmental impact units. Summing up the final score gave environmental impact assessment of the entire project / mining area. Significance of total environmental impact score is given in respective Tables.

Table: 2:Assessment Value Index in Leopold Matrix Procedure

TIS	Impact Assessment
up to (-) 1000	No appreciable impact on environment
(-) 1000 to (-) 2000	Appreciable impact on environment; but not injurious in general. Mitigation measures important.
(-) 2000 to (-) 3000	Significant impact on environment. Major environmental control measures to be taken.
(-) 3000 to (-) 4000	Major injurious impact on environment, Major environmental control measures to be taken and / or site selection for the proposed project to be reconsidered within the buffer zone.
(-) 4000 and above	Alternative site for the proposed project to be selected out side the buffer zone.

Impact of Gypsum Mining and associated activities on Environment

The environmental impact assessment of Gypsum Mining and their associated activities in Bikaner follows identification and quantification of impacts. The activities which have impacts on various environmental parameters are enumerated below and quantified in Table 3 and Table 4.

Table: 3:Project Activities in Gypsum Mining

1	Mining	Includes pitting and excavations.
2.	Waste disposal	Includes disposal of overburden strata comprising soil, silt, Aeolian sand, calcareous sand, mine muck and mining waste
3.	Transportation	Mainly by trucks, water tankers, mining machinery, etc.
4.	Trading	Daily traffic of buyers, brokers etc. and interaction of seller, buyers and brokers.
5.	Grinding	Fine dust due to grinding operations spread in a very large surrounding areas



Table 4: Importance Value of Environmental Parameters-Gypsum Mining and associated activities

Environmental Parameters	Ranking					Total	Weightage	Parameter Importance Value (PIV)
	1	2	3	4	5			
1. Soil and Land use				*		4	4/25	165
2. Water resources		*				2	2/25	100
3. Air and Noise			*			3	3/25	130
4. Flora and Fauna		*				2	2/25	70
5. Socio economics				*		4	4/25	165
6. Civic amenities		*				2	2/25	100
7. Health and Safety			*			3	3/25	135
8. Aesthetics			*			3	3/25	100
9. Human Settlements and historic buildings		*				2	2/25	35
					Σ	25		

Table 5: Environmental Impact Matrix of Gypsum Mining and associated activities in Bikaner (without mitigative measures)

Environmental Parameters	PROJECT ACTIVITIES					PIV	Total Impact Score (TIS)
	Mining	Waste disposal (overburden & mine muck)	Trans- portation	Trading	Grinding Units		
	1	2	3	4	5		
Soil and Land use	-3	-2	-1	0	-1	165	-1155
Water resources	+1	-1	0	0	-1	100	-100
Air and Noise	-3	-2	-2	-1	-2	130	-1300
Flora and Fauna	-1	-1	-1	-1	-3	70	-560
Socio economics	+5	+1	+4	+4	+2	165	+2640
Civic amenities	0	0	+1	+2	+1	100	+400
Health and Safety	-3	-1	-1	0	-1	135	-810
Aesthetics	-3	-1	-1	+1	-2	100	-600
Human Settlements and historic buildings	-1	-1	+1	+1	+1	35	+35
					TIS =		-(1450)

Assessment Value Index (Table 5), shows the calculated value of Total Impact Score (TIS) is -1450 that indicates that there is an **appreciable impact on environment; but not injurious in general**. Mitigation measures have been required to reduce these negative impacts of gypsum mining.

Comparative studies of mined and adjacent un-mined areas suggest that the vegetation of gypsum mines supports Khejri, Kair, and Bordi plants, dab grasses and harmful (*Peganum harmala*) which seems to be an indicator plant for gypsum.

The impact of gypsum mining in the study area slightly negative as TIS has negative sign for gypsum mining (Table 5) because the mining of gypsum does not increase the civic amenities to the great extent and socio-economic aspect has also not been reported in the survey. The reason behind this may be the extent of illegal mining in the region.

In fact in some places the mining of gypsum increased the fertility of the soil and porosity of the soil. Gypsum mining has removed the pervious subsurface gypsum layer (hard pan) as a result of which problem of



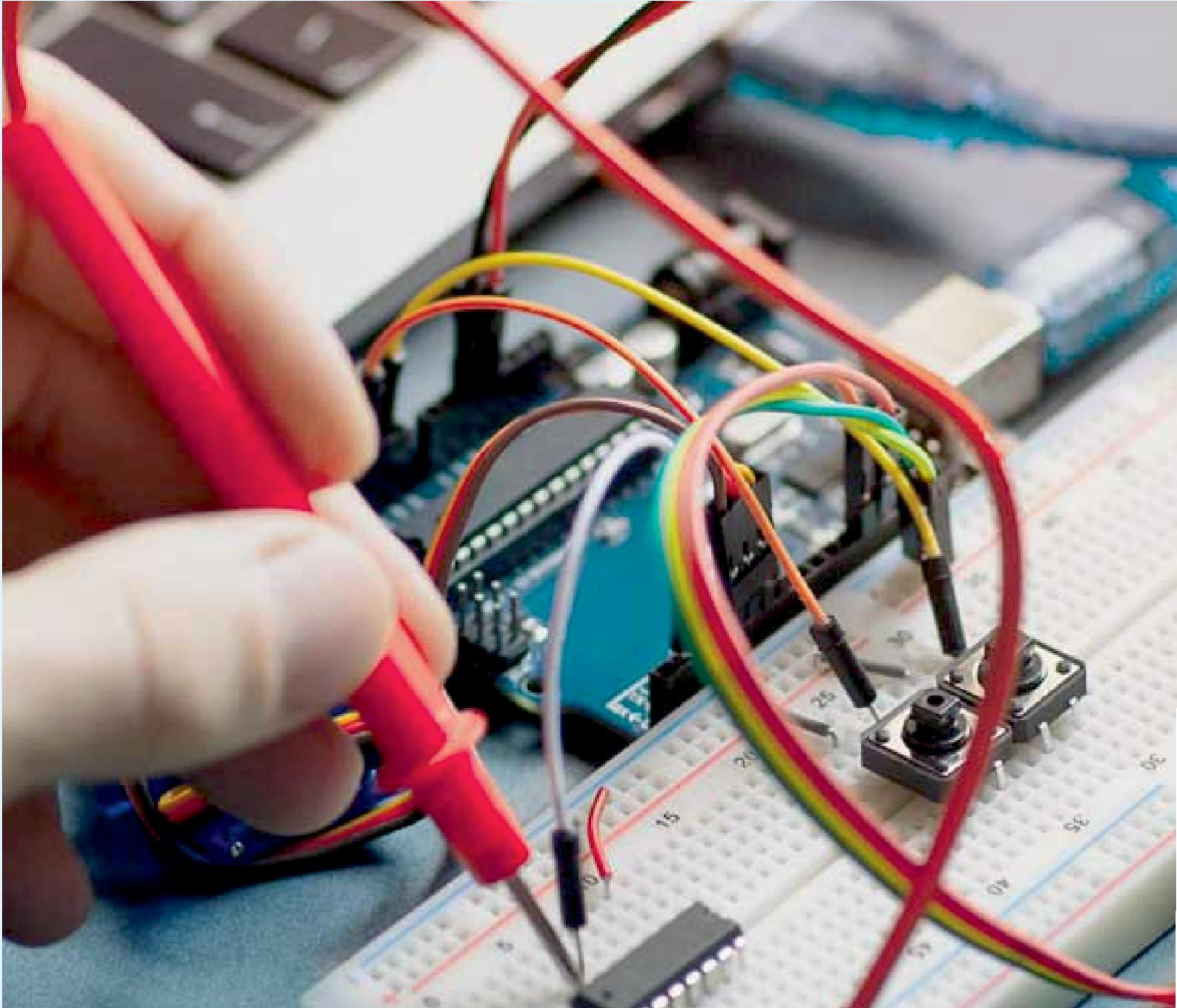
water logging in the concerned areas have also been reduced. This may be the only greatest positive impact of gypsum mining in Bikaner.

SUGGESTIONS

- Mine owners must be held responsible for the rehabilitation of the environment around the mines, including the removal of rubble, powder, etc. to restore vegetation in the mining area and reverse the increasing temperature and soil erosion problems.
- Wherever mining is to be done, the share of the villager in the earnings from this must be specified by the Panchayat and this income should be used for the development and welfare work of the village.
- Before issuing mining pattas for land in a village, the Gram Sabha must be consulted and their approval sought. Also, there must be a total ban on leasing agricultural lands for mining.
- Effective steps must be taken by mine owners to monitor the levels of dust pollution. Experience proves that masks are not the most effective means of health protection in these mines.
- As gypsum is a low cost material and requires bulk transportation, hence to avoid long distance transportation, the bulk consuming industries should be developed around the gypsum deposits or the by-product gypsum producing industrial units.

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