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Improvement of Underground Metal Mine Air Quality and Human Factors through Plantation

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Abstract: ***Mining is essentially a destructive development activity where ecology suffers at the prosperity of economy. Unfortunately, in most sections of earth, the underground geological resources (minerals) are superimposed by above ground biological resources (forests). Hence mining operations unavoidably involves deforestation, habitat demolition and biodiversity loss. The extraction and processing of ores and minerals also lead to extensive contamination of air, land and water. However, mankind also cannot afford to give up the underground geological resources which are basic raw materials for development. In this paper are detailed out the various environmental implications mankind are facing for under taking mining in order to achieve economic prosperity and also explained are the effect of different approaches on mining on the environment. A case study of Balaria Mining area in Rajasthan, India, has given some astonishing disclosure of the impact of mining on ecology of the area.***

Keywords: Air pollution, Water pollution, Land degradation, Environmental impacts, Balaria mining area

I. INTRODUCTION

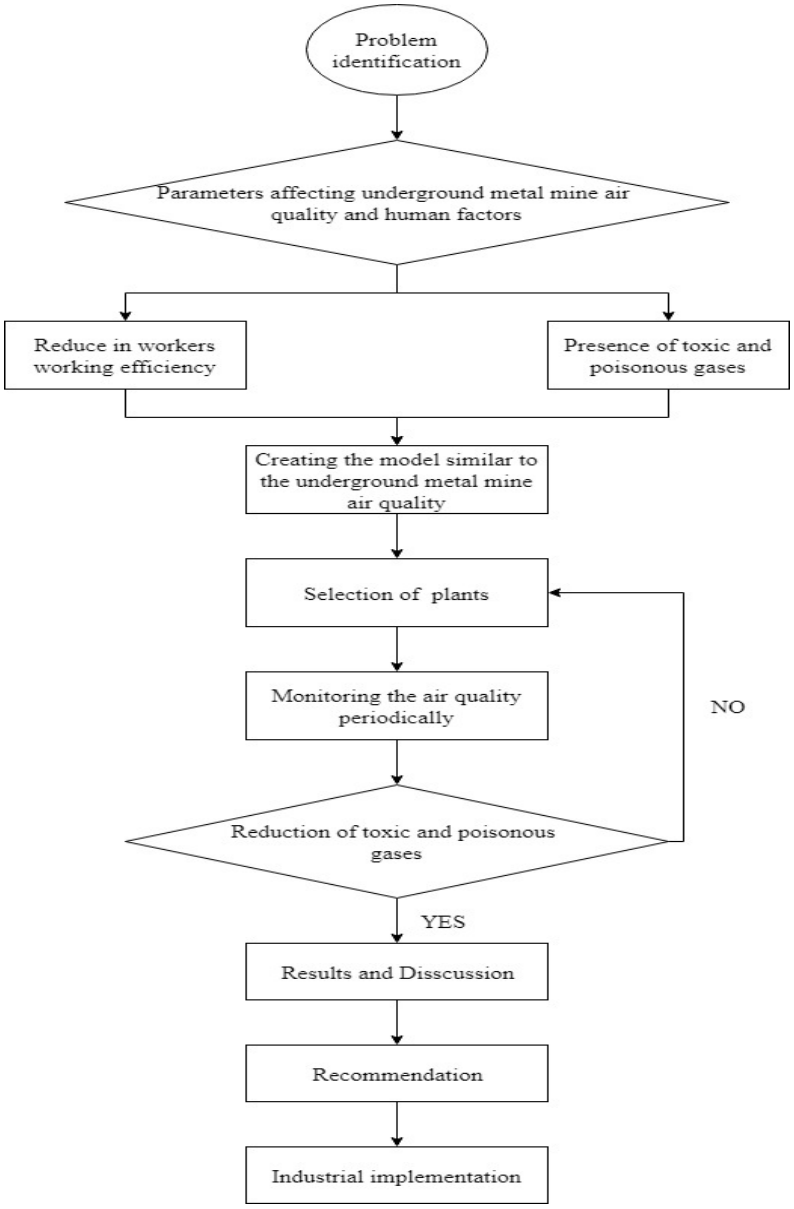
The environt of underground metal mines differs from the normal environment. In underground working area proper lighting is not available and natural ventilationn is completely absent. In this situation underground metalmines faces number of hazards like Fire, Flooding, Roof Collapse, Air contamination, and lack of ventilation.The Ventilation is very important and essential factor for the workers working in underground and also avoid the contamination of mine environment by the toxic and poisonous gases. Air quality in the mine differs from the atmosphere. The air present in the mines is more polluted because of the confined atmosphere, and the gases produced by the combustion of fuel in the engines of machineries operated in underground. The air in the atmosphere has been improved by the plants present in the land which increase of poisonous and toxic gases due to blasting fumes and workshop fumes in the underground mines (Mishra, 1989). Explosion from gases such as methane and coal dust have caused some of the largest mining disasters. They have led to miners being trapped or killed. Layer of coal trap Methane a highly explosive gas. Methane can be released, leading to coal dust explosions when there are mechanical errors from tools that are improperly used or that malfuction. When explosives are also detonated intentionally, they may also leads to to the coal dust explosion. Considering the atmosphere of underground metal mine is very confined and limited, the contaminants may include dust, aerosols, diesel fumes and participates and fumes from blasting, as well as gases released from the rock strata are toxic contaminants in the underground metal mines. Nitrogen dioxide (NO_2), Nitric oxides (NO), and Carbon monoxide (CO), are the few gases get releases durin the blasting of explosives. The poisonous gases may leads to workers death in few seconds when it crosses its permissible limit. The toxic gases also may leads to workers death not sudden but in the few minutes to hours when it crosses its permissible limit. Based on the below classification, the workers have to pay attention in case of below mentioned harmful gases.

II. METHODOLOGY

In everyday life metals will play a major role in human beings life. Metal are very essential to build a home, to construct a bridge, in manufacturing of machines mobile phones etc. This metal can be obtained from the mother earth by mining. Most minerals are located at deep depth of earth, hence surface mining methods are not suitable to extract the mineral present in greater depth, to extract the ores in greater depth underground mining methods are very useful. In underground metal mines conditions are completely different from the surface environment. In underground mines natural ventilation is absent, presence of toxic and poisonous gases are more, the workers will feel uncomfortable while working in underground. However mechanical ventilation is provided to workers but in the roof corners of the working area and other places where the mechanical ventilation fails to reach there the hazardous gases will get accumulated.

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The toxic and poisonous gases accumulated in the working areas of underground metal mines will cause sudden or slow health problems to the workers. The toxic or poisonous gases reaches when reaches more than maximum tolerable limit the workers may feel irritation of some body parts like nose, eyes, ears, etc and the workers may also get severe health problems. The underground metal mines conditions is not similar to the our natural environment, it is very confined hence the workers may also feel uneasy to work and may experience high mental stress Due to these health problems workers efficiency to work will get reduces, indirectly production also comes down. To mitigate the problem related to air quality of underground metal mines and workers psychological problems growing the plants inside the underground metal mines is healthy practice. Plants are plays the major role in purifying the air in the environment hence by doing plantation in underground metal mines the air in the mines can be purified. And also the color and fragrance of the plants gives relaxation to the human beings. Many studies and experiment are proved that growing the plants in the working places will increase the working efficiency of the workers and reduces the work stress of the workers, and hence growing the plants in the confined place like underground metal mines will gives better feeling for workers and increases the working efficiency automatically production also gets improved if the health of the workers is good and they working efficiently. Capital investment to grow the plants also very less. The following methodology was developed to grow the plants in underground metal mines



Flow chart of methodology

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III. PROBLEM IDENTIFICATION

In underground metal mines identified problems for our project are presence of toxic and poisonous gases and their effects on health. And also the psychological problems faced by the workers due to working confined and isolated place like underground metal mines.

A. Hydrogen Sulphide

Hydrogen sulphide (H_2S) is a colourless, flammable, hazardous gas with a rotten egg smell. It is heavier than air and can collect in low-lying and enclosed, poorly ventilated areas such as basement. It is very poisonous, corrosive, and flammable. Hydrogen sulphide is slightly denser than air, a mixture of H_2S and air can be explosive. Hydrogen sulphide is slightly soluble in water and act as a weak acid.

Effects of H_2S to workers

PPM	SYMPTOMS
0.032-0.02 ppm	Olfactory threshold (begin to smell)
5 ppm	Increase in anxiety symptoms (single exposure) and Start of the dose-response curve (short-term exposure)
5-10 ppm	Relatively minor metabolic changes in exercising individuals during short-term exposures
5-30 ppm	Moderate irritation of the eyes
100 ppm	Immediately Dangerous to Life and Health (IDLH concentration)
150-200 ppm	Olfactory fatigue (sense of smell is significantly impaired)
100-1,000 ppm	Serious respiratory, central nervous, and cardiovascular system effects
1,000-2,000 ppm	Loss of consciousness and possible death

B. Carbon Monoxide

Carbon Monoxide (CO) is the colorless, tasteless, and odorless, which is highly poisonous in nature to the workers. The following table 3 gives the levels of Carboxyl hemoglobin (COHb) in the blood which tend to form at equilibrium with various concentrations of CO in the air and the clinical effects are observed.

CO Symptoms

Atm CO(ppm)	COHb in Blood (%)	SYMPTOMS
11	11	Shortness of breath upon vigorous exertion
120	20	Shortness of breath with moderate exertion
220	30	Headache, possible dizziness, dimness of vision
350-520	40-50	Headache, collapse; fainting upon exertion.
800-1220	60-70	Unconsciousness, death if exposure is prolonged
1950	80	Rapidly fatal.

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C. Carbon Dioxide

Carbon Dioxide (CO2) is a trace gas being 0.038% of the atmosphere. It is produced through decomposition of organic materials as well as through respiration and combustion. It is also generated as a by-product of the combustion of fossil fuels or the burning of vegetable matter, among other chemical process. Workers when exposing to the carbon dioxide at different ppm has shown below.

Effects of CO_2 to workers

PPM	SYMPTOMS
0 ppm (0.5%)	OSHA permissible exposure limit(PEL) and threshold limit value(TLV) for 8 hours exposure
10,000 ppm (1.0%)	Typically no effects, possible drowsiness
15,000 ppm (1.5%)	Mild respiratory stimulation for some people
30,000 ppm (3.0%)	Moderate respiratory stimulation, increased heart rate and blood pressure, ACGIH TLV-Short Term
40,000 ppm (4.0%)	Immediately dangerous to life or health (IDLH)
50,000 ppm (5.0%)	Strong respiratory stimulation, dizziness, confusion, headache, shortness of breath
80,000 ppm (8.0%)	Dimmed sight, sweating, tremor, unconsciousness, and possible death

IV. CONCLUSIONS

Underground metal mines are plays a major roles in Indian economy and also in other countries as well. The production is the very important factor for the success of the mining industry, and this is mainly dependent on the workers employed in the mines. If the workers are able to work efficiently the production will increase automatically but the problems in underground metal mines will not allows the workers to work efficiently, the toxic and poisonous gases will cause the health problems to the workers and make them suffer from the disease this will reduce the workers efficiency and also their interest to work. Hence to provide the good working condition to the workers is a duty of the mine owner. Underground mines are isolated and bounded place the workers cannot move to the place other than working areas, this situation may leads to the high mental stress to the workers. Psychological condition of the workers working inside the mines is also not good. To solve these problems plantation in underground metal mines is a good and cost efficient technique. Plants and trees are the main members in the environment to purify the atmospheric air. The plants can use the greenhouse gases for photosynthesis and reduces the amount of greenhouse gases in the atmosphere. This purification of the air by the plants happens automatically and it doesn't needs any investment. Hence if the plants are grown inside the mines the air inside the underground metal mines will get purified. The plants are also gives the shelter to participate matters to get settle on their leaves. Plants are aesthetic in nature and help the workers to get relaxed from the work stress.

From the above experiment we can conclude that the plants can be grown inside the underground metal mines. The selected plants spider and snake plants can grow inside the metal mines with the presence of different toxic and poisonous gases. Using the LED grow light plants can absorb the light to do photosynthesis. The required for these plants is less if the plants are watered once in a week can sustain. The grow lights provided for the plants are also helps to increase the illumination in the working area. The plants can be grown in the nursery of the mines and can be inside the working area. The investment to grow the plans is also less hence plantation in underground metal mines is a better idea to mitigate the hazards affecting the air quality of the underground metal mines

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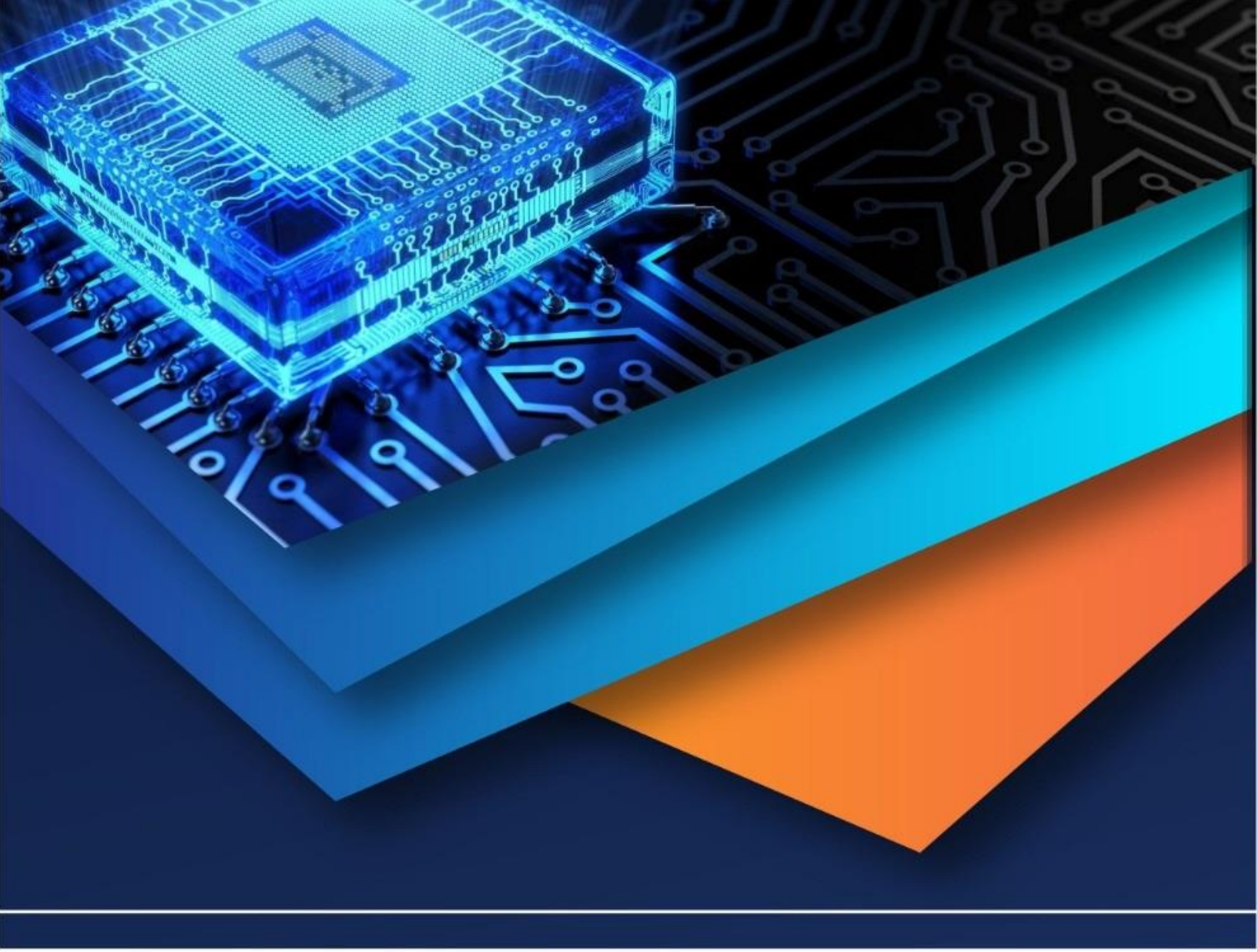
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