EMERGING ENVIRONMENTAL CHALLENGES IN THE EARTH AND THEIR MITIGATION MEASURES

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ABSTRACT

Any material removed from earth looses the natural form of earth, resulting in another dimension of environmental difficulty. This exploitation considers being the exception because without disturbing earth industrialization is not possible. This taking out the material from earth crust (called mining activities) creates misbalancing in earth structures creating different types of environmental problems. So time has come to analyze critically the different trend of challenges and its consequences-cum-implications. In this paper, the component and sub-components of different types of pollutions performed due to mining activities are found out. The response on Govt. and other private voluntary agencies on pollutions are collected and respective suggestions of Environmental Protection Agencies (EPA) are incorporated. Some of the important emphasized points are: i) increasingly complex environmental regulation and the need for multi-disciplinary decision making, ii) increased impact of environmental indicators and in environmental accountability, iii) information and communication technologies as tools in environmental protection, iv) the need for a sustainability ethics in industry, government and individuals etc. these points are categorized in the point scale to find out the Life Cycle Analysis (LCA).The increasing pressures placed on natural resources need to be met with an understanding of the need to use them wisely. While the responsibility has been traditionally placed upon industry, it is becoming increasingly important to likewise hold government as well as individuals accountable. An ethic for conservation, recycling, re-uses and other environmentally sound practices will be critical to ensuring sustainability.While the potential adverse consequences of population growth, economic growth and globalization, increasing energy consumption, new technologies and many other trends are more evident, they likewise present opportunities for less waste generation, less pollution, and beneficial ecological impacts. Efforts to address the adverse impacts of these trends can stimulate the development of environmentally beneficial technologies, products, or fuels, as well as the adoption of new, environmentally sound practices and processes.It is observed that earth is getting disturbed due to mining activities and as a consequence Geo-tectonic movement leading to earthquake occurs very frequently. Any industrialization depends upon getting the raw materials from earth crust. As a consequence scientific environmental analysis should be carried out before opening up the mines and care must be taken to improve the environmental quality and its mitigation so that eco-friendliness can be maintained.

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INTRODUCTION

I. Disturbance due to mining activities
II. Industrialization, population & economic growth, energy consumption
III. Technological advances to reduce environmental impact
IV. Ethical and environment friendly practices

Environmental Impact due to Mining Activity

A. Land degradation (160yr old coal mining - 11000 hectors)

B. Subsidence

C. Mine fires (70 mine fires in Jharia -17.32km^2)

D. Water pollution (Acid mine drainage in Makum coalfields)

E. Flora and fauna

F. Ecology and habitat

Environmental Risks Arising due to Coal Mining Areas

Acid Rain

Population

Deforestation

Ozone Depletion

Greenhouse Gas Emission

Acid Rain

Acid rain is a broad term that is often used to describe several forms of acid deposition. Wet deposition is when rain, snow, fog or mist contains high amounts of sulfuric and nitric acid. When sulfur dioxide and nitrous oxides are emitted into the atmosphere, dissolve in water and fall as precipitation. *Dry deposition occurs when dust and smoke that contain high amounts of sulphur dioxide and nitrogen oxides settle to the ground, or onto buildings, cars and vegetation.* These gases are converted to acids when they come in contact with water.

Population

One third of the total area of the earth is land. At present, the total population of the world is around 700 crores. So restoration of mining areas after abandonment or closure has to be given prime importance. Strict compliance of the Mineral Conservation and Development Rules (MCDR) by the mining operation is warranted.

Deforestation

Coal mining industry in India has caused deforestation of about 8000 hectares till 2010. Forest area in India is only 11.2% and is decreasing at a faster rate. It is estimated that deforestation has released 20-50% as much carbon dioxide in 2010 as the burning of fossil fuel did.

To reduce the problem mining methods can be modified.

Ozone Depletion

Ozone-depleting substances (ODS) influence the formation or destruction of the stratospheric ozone layer. CO, NO_x and non-methane Volatile Organic Compound (VOC) --- ethane, propane, butane are ODS species, stronger though are halogenated compounds such as Chloro Fluoro Carbons (CFC) and CCl_4.

Greenhouse Gas Emission

It is estimated that reforesting 130 million hectares would cut the release of carbon from all human activities by 11%. Scientific monitoring has utilized four main greenhouse gases viz. CO_2, Methane, SO_2, Nitrogen Oxide. Burning of fossil fuels is contributing to the maximum to global warming incidentally. Coal produces most carbon dioxide per unit of heat.

MINE ENVIRONMENT SYSTEM AND ITS EFFECT ON MAN

- **Air**
- **Land**
- **Water**
- **Noise**

IMPACT OF WATER QUALITY ON HUMAN HEALTH

Metallic Released Disease Pollutants	
Arsenic	Vomiting, diarrhea, nausea, abdominal pain, skin, eruption problem in vision, bronchial disorders
Barium	Pneumonites, cardiac strain and heart disease
Cadmium	Kidney, lever, gastro-intestinal tract disorder
Chromium	Apnea, respiratory failure, Paralyses
Copper	Hypertension, sporadic fever, uremia, Coma, brain tissue attack
Lead	Loss of appetite, convulsion, brain damage, mild amenia
Mercury	Growth retardation, sexual impotence, muscular fatigue eye blindness
Selenium	Dullness, erosion of joints, selenosis, stiffness, lameness
Zinc	Vomiting, renal damage, cramps, fever, pneumonites consumption

Permissible Limit in Different Country

Parameter	*USA*	*Japan*	*Russia*	*UK*	*France*	*South Africa*	*Australia*	*India*
Arsenic	100	50	50	50	40	50	50	100
Barium	1000	800	4000	1000	700	900	1000	700
cadmium	10	12	10	15	10	50	15	5
chromium	50	60	100	60	65	60	60	60
copper	1000	10000	100	100	1000	1000	10000	5000
Lead	50	100	100	100	40	50	40	50
Mercury	n.a	1	5	2	4	n.a	2	1
Selenium	10	n.a	1	10	8	10	8	6
Zinc	5000	100	1000	5000	2000	5000	3000	500

ENVIRONMENT vs POPULATION

Environ. deterioration = population size * per capita consumption * environmental impact per unit of production

SL = (Σ Production – Σ Losses) / Population

SL = SL+ (Service + Experience) /(Population * Time)

where,

SL means Standard of Living

&

QL α Acquisitions/ Desires

SUGGESTIVE MEASURES

USING SYSTEM DYNAMIC MODELING

Considering mining industries, environment, society and government.

- profit margins for the industry (PMIN) which as a ratio of annual profit rate to the sales revenue.
- quality of environment index (QEI)
- quality of life index (QLI)
- Annual investment for pollution prevention (API)
- Government net income from the industries (GNII)

Contd……

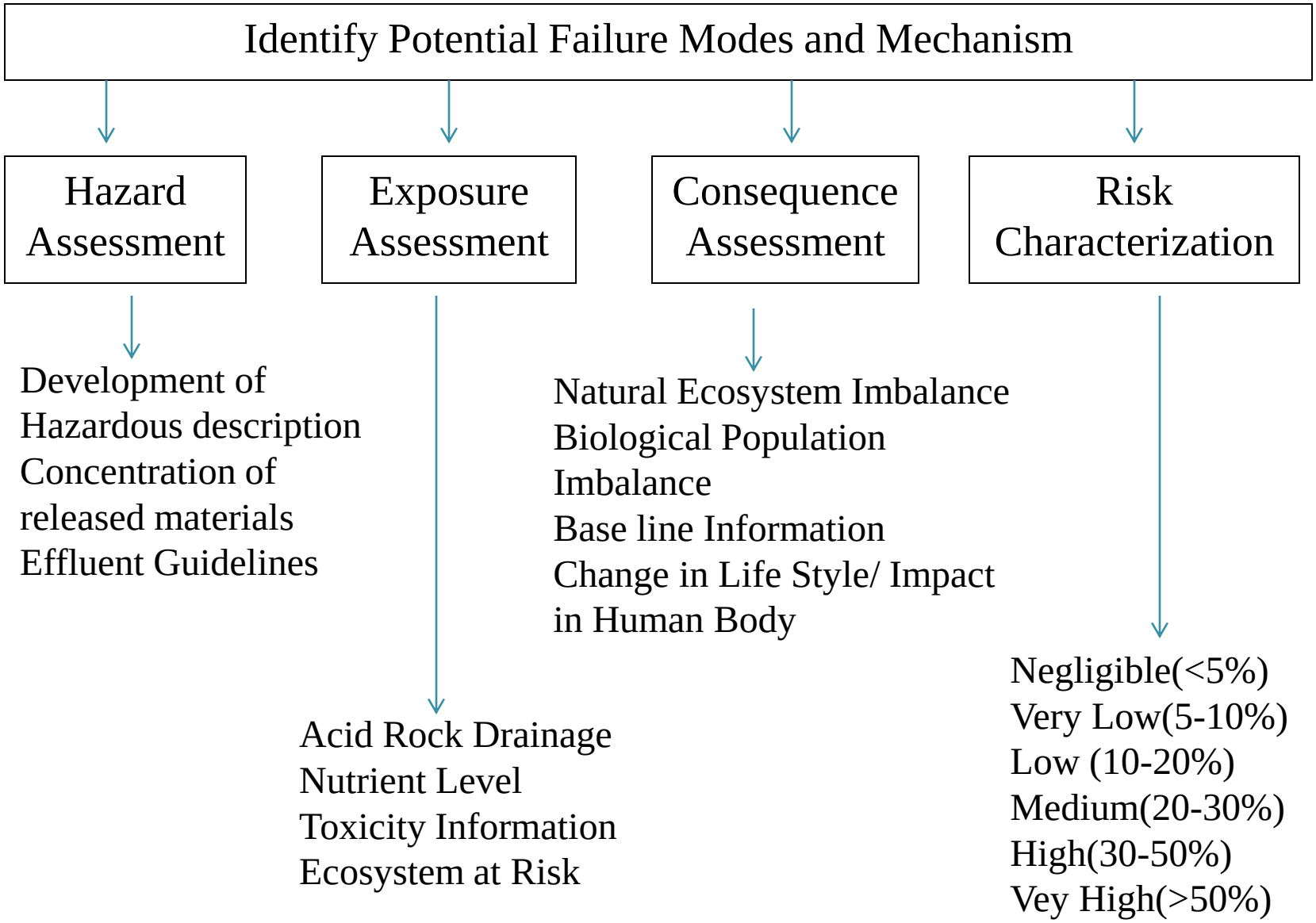
Relationships of the different events in the model

- PGR = SPGR + TIP
- SPGR = TABHL [PGR, QLI, QEI, AP]
- PPIR = PMIR – QLI
- IIPM = OEP + INTEREST RATE
- ERP = APR - AIP
- SP = CP + APGR + QLI
- AP = TABHL {TP, DR, QEI, QLI, OEP}
- PMIR = PPIR – FIP – CP – SP
- PMIN = TABHL {TIP, OEP, QEI, AP}

Analysis of Mining Activities Based on Worksite

- Overall human body performance and its limitations
- Psychological adaptation in the typical working conditions
- Performance evaluation in the critical conditions
- Change in life style with this composite system of environment

Contd.



Method for calculating Quantitative Environment Risk Assessment (QERA)

Utilization Of Abandoned Mines

U/G:

1) Deep mines can be used for R&D work
2) Nuclear disposal
3) Water storage
4) Ash pond for power plants

Opencast:

1) Water reservoir
2) Land reservoir

MITIGATION MEASURES

- Emphasis on closer and more effective interactions within EPA (environmental protection agency)
- Environmental regulation and its need for decision-making
- Environmental indicators vis-à-vis environmental accountability
- Information technologies as tools in environmental protection
- Movement of pollutant outside the state/ country boundaries
- Environmental protection vis-a-vis sustainability ethics

ENVIRONMENTAL PROTECTION

An ethic ensuring sustainability for *conservation*, *recycling*, *re-uses* and other environmentally sound practices will do the needful. Present opportunities for less waste generation, less pollution and beneficial ecological impacts are the measures to be taken into concern. Efforts to address the adverse impacts of these trends can stimulate the development of environmentally beneficial technologies, products, or fuels, as well as the adoption of new environmentally sound practices and processes.

CONCLUSION

Earth is getting disturbed due to mining activities and as a consequence Geo-tectonic movement leading to earthquake occurs very frequently. Any industrialization depends upon getting the raw materials from earth crust. As a consequence scientific environmental analysis should be carried out before opening up the mines and care must be taken to improve the environmental quality and its mitigation so that eco-friendliness can be maintained.

THANK YOU