

## RISK ASSESSMENT & MANAGEMENT

### 1. INTRODUCTION

Risk Assessment normally involves identification of hazards, risk associated with it and to work out strategy to reduce the significant consequences. Hence, there is a need to be aware that there is a risk of an accident, before steps can be taken to prevent it from happening. Although a workplace task may not lead to an accident. It is also necessary to understand what are the risks due to the mining operations and the purpose of Risk Assessment. In Risk Assessment, ‘Hazard’ and ‘Risk’ are often used.

#### **Hazard**

A ‘Hazard’ is defined as a source of potential harm to people, property or the environment. In mining sector, the use of explosives is a major sources of potential hazard. During the use of explosives, a slightest negligence may cause premature initiation causing injury to persons or damage to equipment and due to sudden release of chemical energy can create havoc.

In case of hilly iron ore deposits, where blasting operation has to be carried out near steep hill surface, due to uncontrolled movement of boulder soon after the blast or due to the vibration generated by HEM equipment, causing damage to infrastructure or injury to the persons. Apart from these hazards in open cast mining, the other form of physical hazards are noise and vibration from heavy earth moving equipment and plant.

#### **Risk**

The risk is defined as the “chances or possibility of accidental losses or undesired consequences”. It can be defined in terms of either probability or frequency & the consequences. The risk arises from both a hazard and some uncertainty about its effects. As such, a hazard must be present to give rise to some consequences and risk can be interpreted as the probability of its occurrence multiplied by its consequences.

$$\text{Risk} = (\text{Probability}) \times (\text{Consequence})$$

The frequencies and probabilities of events leading to an incident are assessed to determine risk. All the related incidents need to be studied thoroughly so that a suitable remedial action could be taken. Because there are so many combinations of hazards, incidents and consequences, it is impossible to assess these all. Complicated quantitative approach will be avoided when a simple qualitative approach is available.

#### **Definition of Environment Risk**

The following terms related to environment risk are defined as:

<b>Harm</b>	<b>Damage to the persons</b>
Hazard	Something with the potential to cause harm: this could be characteristic of material being possessed or malfunction of equipment. An environment hazard is thus going to be a set of circumstance which leads to the direct or indirect degradation of environment and damage to the life and property.
Risk	The probability of the harm or likelihood of harmful occurrence being released and its severity. Environment risk is a measure of the potential threats to the environment, life and property.
Consequence	Effect due to occurrence of the event which may endanger the environment permanently or temporarily and/or loss of life and property

Environmental disaster	The consequence is so severe that it can extensively damage any one or all four components of the environment namely physicochemical, biological, human and aesthetic.
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### Risks and Consequences of failure of EMP

Environment management plan has been devised to control the pollution and mitigate the environmental impacts due to the mining project, Failure of this plan will also result in certain risks. It is presumed that the existing mining project has been designed and engineered with all possible safety measures and standard code of practice of engineering. In spite of this, there may be some design deficiency which may damage the life and property including environment as below:

### Mitigation Measures proposed to be Implemented during Operation Phase

Mitigation Measures proposed	Target to achieve	Risks and Consequence of failure, if any
<b>Air Pollution Control</b>		
Water sprinkling will be done in mines area and iron ore sorting area. And during transportation of trucks to control fugitive emissions. Iron ore ready for transportation will be kept in covered sheds or bunkers.	Maintain Ambient Air Quality within the prevailing standard prescribed	Increase in PM emission. Effect on health of workers
Pucca roads within the lease area, water sprinkling in dusty areas and green belt/green cover in 34% of total area to arrest the fugitive dust emission	Maintain Ambient Air Quality within the prevailing standard prescribed	Increase in PM emission. Effect on health of workers
<b>Water Pollution Control</b>		
The mining facilities will not discharge any toxic effluent to the nearby water bodies. To prevent any wash off from dumps the toe wall, garland drains, settling tanks and check dams will be constructed.	Clean and potable grade water to be discharged to the nearby surface water sources.	Increase in TSS concentration and Contamination due to overflow of runoff water to the nearby land/water body
<b>Noise Pollution Control</b>		
Design of equipment Encasement of noise generating equipment.	Control noise level within 90 dB (A) at 1 m distance	Increase in work zone noise levels
In addition personnel working near high noise level generating sources will be provided with ear muffs.	Attenuation of noise in source receptor pathway	Increase in work zone noise levels
Effective preventive maintenance and vibration measurement of all rotating equipment and transport system will help	Protection of sensitive receptor	Health impacts on worker in high noise areas

in the improvement of noise reduction		
<b>Solid Waste Management</b>		
Dumping of intercalated waste generated during mining activity. No top soil to be generated in the current approved scheme of mining	Reuse of solid waste for reclamation as per PMCP.	If land is not reclaimed then there would be open pits where water will accumulate and could be harmful. Contamination of Surface water bodies due to wash offs.
<b>Others</b>		
Green belt development, 525 trees are supposed to be planted per year as per the mining plan.	Ecological improvement Attenuation of air pollutants (SPM, SO <sub>2</sub> and No <sub>x</sub> ) and noise in source receptor pathway	---
Control of fire and Explosion	Safety	Increased risk of accidents due to fire & explosion. Health of workers
The Hazardous waste (used oil from mining machineries) , will be recycled and sold to registered recyclers.	No hazardous waste to be discharged outside the mines location.	Pollution of land, surface water and ground water sources.

## 2. DISASTER MANAGEMENT

### PLAN OBJECTIVE

The objective of DMP is to describe the mining management's emergency preparedness/response, the resources available and response actions applicable to deal with various types of emergencies that could occur at the mining location with the organisation's response structure being deployed in the shortest time possible during an emergency. Thus, the objectives of Disaster Management Plan can be summarised as:

Rapid control and containment of the hazardous situation  
Minimising the risk and impact of event/accident as well as environment  
Effective rehabilitation of the affected persons and prevention of damage to Property

Responsive to render assistance outside the mines location

In order to effectively achieve the objectives of emergency planning, the critical elements that form the backbone of the DMP are:

- Reliable and early detection of an emergency and careful planning
- The command, co-ordination, and response organisation structure manned by efficient and trained personnel
- The availability of resources for handling emergencies
- Appropriate emergency response actions and proper training of Staff
- Effective notification and communication facilities
- Regular review and updating the DMP

### **3. DISASTERS IN THE INES**

Occurrence of disaster in mining industry is there but is less as compared to that of any other chemical and hazard plants. But, in general disaster like fire hazard, failure of building structure, falling of boulders, etc. may occur and such accidental situations can not be totally ignored. Natural disasters in mining area can be of following types:

- Flooding of major water course
- Land slides or failure of slopes.

As the mining areas as well is much above the flood level where there is no possibility of flooding of water. The mines is situated in a hilly region, the failure of slopes or possibility of land slides cannot be ignored specially in rainy season. The precautions needed are boulder pitching, retaining walls, re-vegetation of slopes, counter trenching, garland drains, fencing etc, to avoid such chances. The other hazards that may occur are as follows:

- Fire hazards
- Slope instability
- Erosion and sedimentation
- Road Accidents
- Falling of boulders (big lump of ore)
- Blasting hazards

#### **Fire Hazards**

Adequate fire fighting arrangement will be provided. Adequate number of fire extinguishers will be provided for stores and other service buildings.

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### **Slope instability**

The following factors govern mainly the risk of over burden dump failure:

- Height of the benches
- Slope of the benches
- Slope of the foundation area
- Nature of rock in the foundation area.
- Depth of ground water table in the area.
- Nature of overburden material.

The following precautions will be taken to reduce the risk of failure of dump:

- The height of overburden benches will be restricted to less than 30 m in each tier.
- Topsoil from foundation area will be scraped before starting the dumping of external overburden.
- Garland drains will be made around the external OB dump sites to avoid ingress of rain water to the foundation.
- Levelling, grading and drainage arrangement for top of the dumps will be done.
- Physical/technical and biological reclamation of internal overburden dumps will be carried out.

### **Erosion & Sedimentation**

The mine pit would receive water from the three sources, namely, direct precipitation over excavated area, surface run-off from the surrounding area and seepage from the strata. There is no other factor which can cause loss of human life and equipment, etc. All the necessary precautions will be taken against such eventuality through out the life of the project. There is no water course within the mining lease. There shall be construction of Garland drains & Settling tanks which shall be cleaned periodically to avoid silt formation & smooth discharge of water during monsoon.

### **Road Accidents**

A sufficient arrangement for illumination of roads including haul has been made. Road crossings has been properly planned and designed to prevent vehicular accidents.

### **Falling of Boulders**

During blasting in hard formation, there is every possibility of falling of boulders, which may cause injury to workman. Necessary precaution shall be taken by wearing helmets and providing necessary barricades during blasting to restrict injuries due to boulders.

### **Blasting Hazards**

For proper blasting and minimizing the adverse side effects due to blasting, viz. noise, ground vibration, back-breaks, air blast, fly rocks, etc., the following precautions have

been suggested to avoid dangerous situations:

Before blasting is done, warning sound will be given so that people can move to safe places.

Controlled blasting will be done as and when required.

Blasting will be done in daytime. Frequency of blasting shall be influenced by the availability of the land (tenancy in particular), DGMS permission for use of explosive, mining conditions, method of mining and prevailing meteorological conditions.

Apart from the above mining operations follow statutory mine safety rules administered by the Directorate general of Mine Safety (DGMS), Chief Controller of Explosives and others. Planning and design of electrical installations will take into account the existing electricity rules to obviate the hazards due to use of electricity.

For creating safety awareness and imparting education on safe practices, the following steps shall be taken:

Holding annual safety weeks.

Imparting basic and refresher training to the employees.

### **3.1DISASTER ANAGEMENT**

While natural hazards mostly may be inevitable, disasters are not. A disaster is the result of impact from hazards on society, on infrastructures, cities and other construction. Disasters lead to losses of lives or property, and effects of disaster depend on the vulnerability of the elements at risk and ability of the system to cope with disaster. For effective disaster management, it is necessary to evaluate risks at the mines in a careful manner, evaluate and then take steps for mitigating them. Whatever we may plan to do, 'Safety of the people' shall assume the paramount importance in the midst of all our planning. Hence stress must be given to carefully plan rescue & evacuation responses & training aspects of the Disaster Management Plan. Following procedures will be followed for effective management of any disaster in the mine.

Step-1: Identification of Disaster risk

Step-2: Identification of persons at risk

Step-3: Removal of hazard

Step-4: Evaluation of the risk

Step-4: Control measures to be taken

Step-5: Maintaining Assessment records

Step-6: Review

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### **Identification of Disaster Risks**

Assessment will be made to find out the risks involved in the proposed mining activity when it will be in active stage. A committee comprising Mines Manager, Asst. Managers, Mine Foremans and Mining Mates will be constituted as Disaster Management Committee to assess disaster risks. The committee will meet regularly to deliberate on disaster perception, assessment and ways to mitigate them.

### **Identification of persons at Risk**

An overall assessment of persons at risk will be identified by the above said committee as well as from the associated activities. The committee will then lay down safe procedures to mitigate the risks.

### **Removal of Hazard**

The disaster management committee will try to find out alternative methods, if any, to be adopted to eliminate the hazards.

### **Evaluation of the Risk**

Detail evaluation of risk will be carried out to find out how likely the accident to happen & how serious would be the injury if there were accidents while carrying out the activity.

### **Control measures to be taken**

Regular evaluation will be carried out to find out whether anything else needs to be done. For example, it may be necessary to provide extra training in the safety aspects in use machinery and only trained workers will be allowed to operate the machines.

### **Maintaining assessment records**

The risk assessment will be recorded. As said above, risk assessments will be carried out and the disaster management committee of the mine will properly record its results so that risks can be effectively be mitigated.

### **Review**

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The assessment will be reviewed regularly and every time whenever there are changes in the workplace, members of staff, equipment, systems of work and location.

### **MITIGATION MEASURES**

Good environmental management practices help to reduce natural disaster risks because sound management enhances the ability of society to cope with the impacts of natural

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and geo-hazards. Mine management assures that they would strictly adhere to various environmental legislation, environmental and safety policies and planning, and institutional arrangement to reduce disaster risks in the mines. The following measures shall be taken in the mines:

A well equipped fire-fighting team with free fighting equipment shall be formed. Fire hydrant and fire extinguisher will be installed in most of the premises.

During the crushing, screening and conveying, there is every possibility of falling of boulders, which may cause serious injury to workman. Necessary precaution shall be taken by wearing helmets and providing necessary barricades in process units to restrict the falling of boulders.

To avoid electrocution, particularly during rainy season loose and open temporary electric connections will be avoided.

In spite of safeguards mentioned above disasters may occur. In such eventualities a systematic approach may save many casualties. Speed and safety of persons engaged in rescue operations are two important requirements of dealing with emergencies. The following emergency measures during disaster and after disaster have been suggested to meet with such situation:

A group of workers shall be trained to tackle probable disastrous conditions. Adequate protective clothes, respirators, ladders etc. shall be at ready disposal.

Sufficient escape routes shall be earmarked from the potential danger areas and electrical premises. The escape routes will be kept unobstructed.

Fire hydrant and fire extinguishers shall be regularly tested and kept in proper working conditions.

Dispensaries, first aid services and other medical services shall have adequate measures to face unforeseen disaster in the plant.

Training and refresher courses for all employees working in the plant premises shall be given.

Apart from the above, the following measures will be taken for guarding the mines workers against occupational and community health hazards:

Steps to control respirable dust, improve workplace environment and reduce noise nuisance.

Periodic medical examination (PME) of workers.

Rehabilitation and treatment of workers affected and suffering from early stages of occupational diseases associated with mining.

Availability of improved medical facilities.

With adoption of above preventive measures, the operation of the mines will be safe as well as environment friendly.

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#### 4. OCCUPATIONAL SAFETY AND HEALTH

Occupational safety and health is very closely related to productivity and employee – employer relationship. The main factors of occupational health in such mines are dust and noise. To avoid any adverse effect on the health of workers due to dust, noise and vibration etc., sufficient measures have already been addressed.

The Lessee will provide all necessary provisions under DGMS rules. In addition, a Safety committee will be formed and manned by equal participants from Management and Workers. Safety shoes, helmet & uniform will be issued to each worker. Other safety equipments will be used according to the nature of job involved. The management will establish its resources for occupational health survey headed by experienced Doctors with a team of Nurses and Pathologist.

Safety in the workplace is critical to the success of running a business, no matter what size it is. Even if you don't have any employees, you must ensure that your business doesn't create health and safety problems for your customers and the general public.

Health examination & monitoring schedule

##### **Medical examinations**

The following medical examinations are proposed:

- 1 Comprehensive Pre-employment medical check up for all employees.
- 2 X-ray of chest to exclude pulmonary TB, Silicosis etc.
- 3 Lung Function test.
- 4 Audiometer test to find deafness.

##### **Schedule**

The following schedule for medical checkup is proposed:

- 1 Comprehensive Pre-employment medical check up for all employees.
- 2 Chest X- Ray once a year for workers 3 Chest X- Ray for all other employees once every 3 years.
- 4 Lung function test for all employees once every 3 years.
- 5 Clinical examination of all employees once every year.

Comprehensive medical examination will be done for all the employees after retirement and all those employees with more than 5 years of service leaving the company. After retirement, medical examination facility will be provided for a period of 5 years. The periodicity of this examination will be once in 3 years for employees in the ore crushing area of the plant. For other employees it will be once in 5 year.

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