RISK ASSESSMENT

GENERAL
Mining operations are associated with several potential hazards that affect adversely the human health and environment. It would normally require the assistance of emergency services to handle it effectively. The mining operation will be taken up under the supervision and control of qualified staff including Mine Manager. Nevertheless, the following natural/industrial problems may be encountered during the mining operation.

1. Inundation due to excessive rains.
2. Accidents by heavy machinery.
3. Slope failures at the mine faces etc.

HAZARD IDENTIFICATION AND RISK ASSESSMENT METHODOLOGY
All types of industries face certain types of hazards which can disrupt normal activities abruptly. Similar mining also has risks which need to be addressed for which a disaster management plan has been formulated with an aim of taking precautionary steps to avert disasters and also take such action after disaster which limits the damage to minimum. In the sections below, the identification of various hazards, probable risks during the operational phase of the mining, maximum credible accident analysis and consequences analysis are addressed either qualitatively or quantitatively.

Risk assessments will help mine operators to identify high, medium and low risk levels. This is a requirement of the Occupational Health and Safety Act 2000. Risk assessments will help to priorities the risks and provide information on the need to safely control the risks. In this way, mine owners and operators will be able to implement safety improvements. The following natural/industrial problem may be encountered during the mining operation.

- Inundation: Filling of the mine pit due to excessive rains,
- Blasting: Fly rocks and Boulders,
- Drilling: Noise and Vibration,
- Handline of overburden and heavy machinery.
- Storage of diesel,
- Slope failures at the mine faces or stacks.

As per proposal made under the mining plan the area will be developed by means of opencast mining method. Extraction of minerals is to be carried out by mechanized mining means. Water table will not be touched during the mining process. No high risk accidents like landslides, subsidence flood etc have been apprehended.

Risks due to Inundation
Mining will be done during the non-monsoon periods therefore problem of inundation is not likely to happen.

Risks due to Failure of Pit Slope
In order to allay dangers due to open cast slope failure, final pit, slope stability estimations will be made for the existing mines. Determining the factor of safety, the slopes should be monitored at regular intervals to check for any possible failure.

Risk due to Handling of Over burden and Heavy Machinery
During the mining, most of the activities are done by the vehicles and the heavy machinery for mining and handling of the mineral. There is no overburden or waste will be generated during the first five year of mining operation. Heavy machinery also causes for accidents due to mechanical failure.
Risks of Accidents due to Trucks and Dumpers

Identifying the hazards that come along with the presence of vehicles at the workplace (e.g. reversing operations, loading) can cause harm if not properly handled. Among some of the factors that may make vehicle accidents more likely are:

- Rough access roads
- Time pressure
- Inadequate brakes (Possibly from lack of maintenance)
- Carelessly parked vehicles (e.g. being parked on a slope without being adequately secured)
- Unsafe coupling and uncoupling of trailers, and
- Untrained drivers
- Overturing vehicles

To avoid such instances, we will talk to the workers and their representatives and will involve them in the risk assessment process and tell them what to do, to reduce risk. All transportation within the mine lease area should be carried out directly under the supervision and control of management.

- The vehicles will be maintained in good working condition and checked thoroughly at least once a month by the competent person authorized for the purpose by the management.
- Road signs will be provided at each and every turning point up to the main road (wherever required)
- To avoid danger while reversing the vehicles especially at working place/loading points, stopper should be posted to properly guide reversing/spotters operating.
- Only trained drivers will be hired.

Storage and use of Explosive Materials

- Proper and safe storage of explosives in approved and Licensed Magazine.
- Proper, safe and careful handling and use of explosives by competent Blasters having Blaster’s Certificate of Competency issued by DGMS.
- Proper security system to prevent theft/ pilferage, unauthorized entry into Magazine area and checking authorized persons to prevent carrying of match box, lights, mobile phones, cigarette or Biri etc.
- Conventional explosives shall be used in their original cartridge packing and such cartridge shall not be cut to remove explosive for making cartridge of different size.
- Explosives shall be conveyed in special containers.
- The holes which have been charged with explosives will not be left unattended till blasting is completed.
- Before starting charging, clear audible warning signals by Sirens will be given so that people nearby can take shelter.

The results of risk assessment are given in table below:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Activity</th>
<th>Hazard Description (Risk)</th>
<th>Score</th>
<th>Risk Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Site planning and layout</td>
<td>Travel in moving vehicle in uneven terrain</td>
<td>1</td>
<td>Level 3</td>
</tr>
<tr>
<td>2.</td>
<td>Storage of explosives</td>
<td>Unintended explosions (exposure to overpressure)</td>
<td>1</td>
<td>Level 1</td>
</tr>
<tr>
<td>3.</td>
<td>Charging of explosives</td>
<td>Unintended explosion or exposure (exposure to overpressure)</td>
<td>1</td>
<td>Level 3</td>
</tr>
</tbody>
</table>
By arranging the above hazards from highest to lowest, the hazards were re-arranged as per their risk levels. Ranking of hazards based on risk levels are provided below in the Table.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Activity</th>
<th>Hazard Description (Risk)</th>
<th>Risk Score</th>
<th>Risk Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Site planning and layout</td>
<td>Travel in moving vehicle in uneven terrain</td>
<td>2</td>
<td>Level 2</td>
</tr>
<tr>
<td>2.</td>
<td>Storage of explosives</td>
<td>Unintended explosions (exposure to overpressure)</td>
<td>15</td>
<td>Level 1</td>
</tr>
<tr>
<td>3.</td>
<td>Charging of explosives</td>
<td>Unintended explosion or Exposure (exposure to overpressure)</td>
<td>3</td>
<td>Level 3</td>
</tr>
<tr>
<td>4.</td>
<td>Blasting</td>
<td>Hit by fly rock (bodily injuries)</td>
<td>2</td>
<td>Level 3</td>
</tr>
<tr>
<td>5.</td>
<td>Bench Formation</td>
<td>Rock falls or slide due to lack of bench face stability (bodily injuries)</td>
<td>15</td>
<td>Level 1</td>
</tr>
<tr>
<td>6.</td>
<td>Crushing and sizing of ROM</td>
<td>Hit by Machineries – Electrical Equipment (bodily injuries)</td>
<td>9</td>
<td>Level 2</td>
</tr>
<tr>
<td>7.</td>
<td>Transportation of minerals</td>
<td>Vehicle Accident (bodily injuries)</td>
<td>50</td>
<td>Level 1</td>
</tr>
<tr>
<td>8.</td>
<td>Transportation of minerals</td>
<td>Accidental fire in vehicle (bodily injuries, exposure to heat radiation)</td>
<td>5</td>
<td>Level 3</td>
</tr>
</tbody>
</table>

**Hazard Analysis**

Broadly, the hazards cover explosive material management, working at heights, slope and bench stability, mineral transport, mineral processing and force majeure conditions (rainfall and flooding). The mechanisms due to which hazards (coming under Risk Levels 1 and 2) may actually occur are covered in Table.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Hazard Description (Risk)</th>
<th>Risk Score</th>
<th>Risk Level</th>
<th>Cause Analysis</th>
</tr>
</thead>
</table>
| 1      | Travel in moving vehicle in uneven terrain | 2          | Level 3    | • Poor visibility
• Incompetent driver
• Poorly maintained vehicles |
| 2      | Unintended explosions (exposure to overpressure) | 15         | Level 1    | • Defective explosives
• Improper storage of explosives
• Force majeure conditions such as lightning strike
• Fire (can be caused by unsafe practices or as ignition)
• Sabotage |
| 3      | Unintended explosion or exposure (exposure to overpressure) | 3          | Level 3    | • Defective explosives
• Outdated explosives
• Improper storage of explosives
• Force majeure conditions such as lightning strike
• Fire (can be caused by unsafe practices or as arson)
• Sabotage |
| 4      | Hit by fly rock (bodily injuries)           | 2          | Level 3    | • Poor access control of blast area
• Poor blasting practices (leading to excessive fly rock) |