

RISK ASSESSMENT

Mining and allied activities are associated with several potential hazards to both the employees and the public at large. A worker in a mine should be able to work under conditions, which are adequately safe and healthy. At the same time the environmental conditions should be such as not to be impair his working efficiency. This is possible only when there is adequate safety in mines.

1. IDENTIFICATION OF HAZARDS

There are various factors which can create unsafe working conditions in mining of minor minerals from river bed. These hazards are as follows:

- a) Inundation / Flooding
- b) Quick Sand/Morrum Condition
- c) Drowning
- d) Accident due to vehicular movement
- e) Accident during sand/morrum loading, transporting and dumping

1.1 INUNDATION/FLOODING

- a) The possibility of inundation/flooding of the mines are very high during monsoon or during heavy rains as the mine area lies in the riverbed.
- b) There is danger to the trucks and other machineries due to flooding.
- c) There is danger to the workers working in the mines.

Inundation or flooding is expected and beneficial for these mines as during this time only the mineral reserve gets replenished.

1.2 QUICK SAND CONDITION

Quick sand/ morrum is a colloidal hydrogel which consists of fine granular material (such as sand/morrum or silt) clay, and water. Quick sand/morrum condition arises in saturated loose sand/morrum when the sand/morrum is suddenly agitated. When water in the sand/morrum cannot escape, it creates liquefied soil that loses strength and cannot support weight. This condition occurs when the permeability of the strata is very high and the effective stress in the sand/morrum becomes zero due to influx of water i.e.

$$i = i_{cr} = y'/y_w -$$

where,

i = Hydraulic gradient,

i_{cr} = Critical Hydraulic gradient,

y' = submerged unit weight,

y_w = unit weight of water.

This creates dangerous condition to the trucks and other machineries plying over the sand/morrum dunes on the river banks.

1.3 DROWNING

There are no possibilities of drowning in the river, since mining operations are carried out only in the dry seasons. All mining activities will be stopped during the monsoon season.

1.4 MINERAL LOADING

- a. The minerals are loaded in the trucks using hand shovels. There is possibility of injury in the hands during loading with shovels.
- b. There is possibility that the workers standing on the other side of loading may get injury due to over thrown sand/morrum with pebbles.
- c. There is possibility of workers getting injured during opening of side covers to facilitate loading.
- d. There is possibility of riverbank collapse.
- e. There is a chance of falling of cattle/children into pits in river bed.

1.5 TRANSPORT

The minerals loaded in trucks/ trolley are being sent to through public roads.

Tractor trolleys 117

Trucks/tippers 50

- a. Possibilities of road accidents.
- b. Accident may also occur during movement in the mine.
- c. There are possibilities that due to overloading, pebbles or boulders may injure the passersby.

1.6 MITIGATION OF HAZARDS

1.6.0 MEASURES TO PREVENT ACCIDENTS DURING LOADING

1. The trucks will be brought to a lower level so that the loading operation suits to the ergonomic condition of the workers.
2. The loading will be done from one side of the trucks only.
3. The workers will be provided with gloves and safety shoes during loading.
4. Opening of the side covers (pattas) will be done carefully and with warning to prevent injury to the loaders.
5. Operations during daylight only.
6. It will be ensured that no foreign material will remain/spilled either in riverbed or catchment in the pits/pockets of area.
7. Stockpiling of extracted material on the river bank will be avoided.

1.6.1 MEASURES TO PREVENT ACCIDENTS DURING TRANSPORTATION

1. All transportation within the main working will be carried out directly under the supervision and control of the management.
2. The Vehicles must be maintained in good repairs and checked thoroughly at least once a week by the competent person authorized for the purpose by the Management.
3. To avoid danger while reversing the trackless vehicles especially at the embankment and tipping points, all areas for reversing of lorries will as far as possible be made man free.
4. A statutory provision of the fences, constant education, training etc. will go a long way in reducing the incidents of such accidents.
5. Overloading will strictly not be permitted.
6. The trucks will be covered and maintained to prevent any spillage.
7. The maximum permissible speed limit will be ensured.
8. The truck drivers will have proper driving license.

1.6.2 MEASURES TO PREVENT DANGEROUS INCIDENTS DUE TO INUNDATION/FLOODING

Inundation of flooding is expected and beneficial for these mines as during this time only the mineral reserve gets replenished.

1. During monsoon months and heavy rains the mining operations are ceased.

2. There will be mechanism/warning system of heavy rains and discharges from the upstream dams.
3. An excavation plan as given in pre-feasibility report will be formulated and periodic mock-drills will be carried out regularly at mine site to conquer any unavoidable circumstances.

1.6.3 MEASURES TO PREVENT QUICK SAND CONDITION

1. The only way to avoid quick sand/morrum condition is by avoiding mineral lifting below water table.
2. The critical hydraulic gradient (i_{cr}) will be maintained at less than 1 to prevent high artesian pressure in a coarse sand/morrum area.
3. At least 0.5m sand/morrum bed should be left in-situ while excavating sand/morrum from riverbed.

1.6.4 MEASURE TO PREVENT DROWNING

1. The mining will be done under strict supervision and only during the dry season.
2. Deep water areas must be identified.
3. No go zones will be clearly marked and mine workers will be informed.
4. Safety mock drills will be organized for rescue operations.

1.6.5 NATURAL RESOURCE CONSERVATION

Mining at the concave side of the river channel will be avoided to prevent bank erosion. Similarly meandering segment of a river should be selected for mining in such a way as to avoid natural eroding banks and to promote mining on naturally building (aggrading) meander components.

1.7 SOCIAL IMPACT ASSESSMENT

Detail Social Impact Assessment study has been done and given in Chapter-3.

1.8 RESETTLEMENT & REHABILITATION PLAN

Not applicable.

1.9 DISASTER MANAGEMENT

All types of industries face certain types of hazards which can disrupt normal activities abruptly and to disaster like fires, inundation, failure of machinery, explosion, to name a few. Similarly

Sand mines also have impending dangers or risk which need be addressed for which a disaster management plan has been formulated with an aim of taking precautionary steps to avert disasters and also to take such action after the disaster which limits the damage to the minimum. Nevertheless, the following natural/industrial problems may be encountered during the mining operation.

1. Inundation- filling of the mine pit due to excessive rains.
2. Slope failures at the mine faces or stacks.
3. Accident due to storage of explosive and blasting.
4. Accident due to fire.

As per proposal made under the mining plan, during proposed working the area will be developed by means of manual opencast mining method. Exploitation and transportation of minerals are to be carried out by manual means. Water table will not be touched during processed working. No high risk accidents like landslides, subsidence flood etc. have been apprehended. But possibility of accidental disaster is also not ruled out. Therefore, all the statutory precautions should be taken for quick evacuation as per the Mines Act 1952, the Mines Rules 1955, MMR-1961 and MCDR-1988.

Risk Assessment and Disaster Management Plan

Like any other industry riverbed mining has risk and dangerous impending which are to addressed by Risk Assessment and Disaster Management Plan to limit the disasters to a minimum level formulation as well as execution of Disaster Management Plan is very important. This is possible only when there is adequate safety in mines. Hence, mine is one of the most essential aspects of any working mine, safety of the mine and the employees is taken care of by the mining rules & regulations, which are well defined with laid down procedure for safety, which when scrupulously followed safety is ensured not only to manpower but also to machines & working environment.

Possible Risks Due To Inundation & Its Control

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

Dewatering

Depth of mine is limited to 3m only from the river bed level whereas the ground water flows at 16m to 18m below the bed level. Hence no dewatering is required.

Possible Risks Due To Failure of Pit Slope & Its Control

Pit will be created of limited depth only i.e. 3m thus the chance of failure of pit slope does not exist.

Possible Risks Due To Failure of Waste Dump & Its Control

No waste dump is created therefore the question of failure of waste dump does not exist.

Possible Risks Due To Fire & Its Control

The operation does not anticipate any fire disaster.

Measures to Prevent Accidents Due to Trucks and Dumpers

- ❖ All transportation within mining lease working will be carried out directly under the supervision and control of the management.
- ❖ The vehicles will be maintained in good 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 equipments/ vehicles especially at the working place / loading points, stopper will be posted to properly guide reversing/ spotting operating, otherwise no person should be there within 10 km radius of machine.
- ❖ A statutory provision of the fences, constant education and training etc. will go a long way in reducing the incidents of such accidents.

Other Possible Measures to Avoid Risks/ Disaster Due to River Bed Mining.

- ❖ Unwanted material including mineral or spillage (if any) will not be stacked on the banks as it will hinder the flow of water in monsoon season.
- ❖ Mining of minerals / working will be started from the centre from dip to rise and then laterally in ½ Meter slice so that the river course could not get affected.

- ❖ The minerals will be mined out in a uniform way so that the river flow/ course shall not get disturbed.
- ❖ River banks will not be excavated to form access ramps. Only excavated river gravel should be used to deposit against the river bank to form access ramps.