

1.1. Risk Assessment

The mining activities involve certain types of hazards, during operation and close, which can disrupt normal activities abruptly and lead to disaster like fires, inundation, failure of machinery, explosion, to name a few. The impending dangers or risks, which need be investigated addressed, disaster management plan formulated with an aim to taking precautionary steps to avert disaster and to take such action after the disaster, which limits the damage to the minimum.

Nevertheless, the following natural/industrial problem may be encountered during the open cast riverbed mining operation at the mine site.

- Inundation is mine pits.
- Failure of Slope of riverbanks.
- Surface fire (Oil).

In order to take care of above hazards/disasters, the following will be strictly followed:

- Working of mines as per approved plans.
- All safety precautions and preventions as per DGMS requirement for risk and safety shall be strictly followed during all mining operations.
- Regular maintenance of transport vehicles.
- Entry of unauthorized persons will be prohibited.
- Periodic checking of worthiness of firefighting and first aid provision in the mining area.
- Training and refresher courses for all the employees.
- As a part of disaster management plan, a rescue team will be formed by imparting specialized training to select mining staff.

1.2. Inundation Studies

The area experiences worst storms causing rainfall during monsoon season Though no mining activities is envisaged during monsoon season (June to September), yet in the context of the present mine the inundation cannot be ruled out due to flash flood in the catchment during non-monsoon season as is evident from **Table 7.8**. It is inferred from the Table that during non-monsoon season the monthly rainfall ranging from 27-115 mm was observed and in a single day 83 mm (09-11-1982) occurred to generate run-off corresponding to maximum one day rainfall of 20.52 mm.

Table 1.1 : Monthly Maximum and a single day Rainfall (mm) during non-monsoon season

Tehsil	Maximum Monthly Rainfall (mm) during non-monsoon season (1973-2012)		Run-off from Maximum Rainfall
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	Jan	Feb	Mar	Apr	May	Oct	Nov	Dec	Maximum Rainfall (mm) in any day	mm	MCM
Jahazpur	27	84	90	44	62.2	115	105	61	83 (09-11-1982)	20.52	22.22

Following precautionary measures shall be undertaken in respect of mining operation during non- monsoon season and before the onset of monsoon

- The local nalas will not be obstructed/diverted along the boundary of lease area.
- A careful assessment of the danger of inundation from surface water shall be made before onset of monsoon season every year and adequate precautions against such dangers shall be implemented.
- Effectiveness of precautions, obstruction in normal drainage system etc. shall be checked regularly.
- During May no mining pit excavation shall be carried out adjacent to the bank offset line
- Standing orders for withdrawal of persons and mining equipment from mine in case of apprehended danger shall be framed and enforced.

1.3. Disaster Due to Failure of Pit Slope

The excavation of a pit in a river bed can be construed as disturbing the continuity of the earth mass at the surface of excavation. The failure in an earth mass may be looked upon as loss of continuity caused by shearing stresses brought into play by the act of removing earth mass. The riverbed material in question comprises of gravel, bajri, sand, silt and clay and can be treated as cohesive – frictional (c - ϕ) type of soil.

The mining involves mechanized excavation in pits of 3 m depth from the natural surface level in the riverbed by deploying excavators. The riverbed material is a consolidated matrix comprising of gravel / bajri / sand and sand/silt/clay and thus has an angle of repose of 40° - 45° . Since the depth of the pit is 3m and the slope material has a good angle of internal friction, probability of any planer failure, or wedge failure of pit are not there. If the depth of cut is too high, there is possibility of slope collapse, which releases a sediment cloud. This will further move outside the suction radius of dredged head. In order to avoid this typical situation, the depth of cut may be restricted to:

$\gamma H/C < 5.5$, where,

γ - Unit weight of the soil

H - Depth of soil

C - Cohesive strength of soil

In the present case $\gamma = 1850 \text{ kg/m}^3$

$H = 3 \text{ m}$

$C = 750 \text{ kg/m}^2$

Therefore $\gamma H/C = 7.4$ which is more than 5.5. Hence the pit mining in 3 m depth is safe from stability consideration of slope. Otherwise also the safety factor against slope failure has been worked out as under by adopting Taylor stability curve for stability number $N=0.035$ for angle of slope of 40° .

$$F = C/N\gamma H = 750/0.035 \times 1850 \times 3 = 3.8 \text{ which is more than } 1.5 \text{ (SF)}$$

The riverbed in most of the rivers has become a consolidated matrix comprising of gravel, bajri, sand, silt and clay and thus the soil is classified as c - ϕ i.e. it has both cohesion as well as internal friction.

1.4. Disaster Due to Failure of Mine Waste Dump

Sliding of surface waste dump is an equally severe risk compared to quarry slope failure. Hence, it is imperative that the degree of hazard against potential failure of waste dump slopes should be identified and that precautionary measures are adopted, if required. The overall waste dump slope, considering the angle of repose, should not be more than 35° - 37° .

In the present case of riverbed mining, the mine waste material is silt and clay which have been proposed to be disposed in the area designated for plantation and shall be properly dressed and levelled for creation of the green belt / plantation. Thus, no surface dumps have been proposed under the plan. The natural heap surface of about 0.5m - 1m high have an angle of repose of about 25° are quite safe.

1.5. Disaster Due to Surface Fire

The chances of surface fire resulting per se from the riverbed mining activities are well-nigh impossible except for the mining machinery and transport vehicles catching and engulfed in fire due to electrical fault like short circuiting and other reasons. In winters the labour some time use fuel wood to warm themselves. The fire can result from the negligence of the labour, but it will be localized and shall not spread as the core zone area of the mine has no appreciable woody material, which can easily catch fire. As a safety, measure against fire hazard a couple of fire extinguishers will be installed at rest shelter and refilled periodically.

1.6. Disaster Management Plan

In order to handle disaster/emergency situations, an organizational chart entrusting responsibility to various project personnel will be prepared with their specific roles during emergency.

1.6.1. Planning

1.6.1.1 Identification and Prevention of Possible Emergency Situations

Possible emergency situations can broadly be classified into vehicle collision, and inundation. Some of the ways of preventing emergencies are as follows:

- Preparation of a Preventive Maintenance Schedule Programme and also covering maintenance schedules for all mining machinery/equipment and instruments as well as transport vehicles as per recommendations of the manufacturers user manuals,
- Ensuring the compliance of traffic rules strictly along Katcha roads (haul roads) within the mine lease area as well as outside the mine lease area.
- Emergent situation arise due to happening of some incident culminating into an abnormal situation. It implies that sufficient time space running from a few seconds to few minutes are always invariably available to arrest an incident of abnormal situation from turning in to an emergency.

1.6.2. Implementation

Following key personnel, identified for carrying out specific and assigned duties in case of any kind of emergency, shall be available on call on holidays and off duty also.

- Mine Manager
- Personnel Officer
- Foreman
- Senior Mining Mate
- Essential workers

1.6.2.1 Responsibilities of Mine Manager

- To take overall charge at the place of incident and activate the Emergency Preparedness Plan according to severity of situation.
- Inform Doctor to be ready for treatment of affected employees and intimate their relatives.
- To depute staff carry out following functions -
 - ✓ To liaison with District Administration and other Departments and guide their personnel
 - ✓ To supervise Assembly and Evacuation at all points
 - ✓ To look after Patients who are bed ridden and any Casualties and give psychological support
- Inform and liaise with project proponent, Police department and District Emergency Authority.

- Arrange for chronological records of emergency to be maintained.
- Issue authorized statements to News Media.

1.6.2.2 Responsibilities of Mines Foreman

- To take immediate charge at the site of incident and ensure that immediate steps as per Emergency Preparedness Plan are taken and immediately inform Mines manager.
- Shall disseminate the information regarding emergency by blowing of Siren / Hooter.
- Supervise assembly and evacuation as per plan, if required and ensure that casualties are receiving proper medical care.
- Ensure accounting for personnel and rescue of missing persons.
- Control traffic movement in Quarry premises.

1.6.2.3 Responsibilities of Trained Workers

A task force comprising of specially trained staff to act and deliver in the emergency situation shall carry out the following work.

- Firefighting and spill control till fire brigade takes the charge and thereafter assist the fire brigade
- Ensuring safety and Isolating equipment, materials, urgent repairing or replacement, electrical work etc.
- Controlling movement of equipment, transport vehicles, special vehicle at the mine site.
- Extending First - Aid and medical help.
- Assistance at casualty's reception areas to record details of casualties.