Additional Studies

7.2 Risk Analysis & Disaster Management Plan

Background

The methodology for the risk assessment has been based on the specific risk assessment guidance issued by the Directorate General of Mine Safety (DGMS), Dhanbad, vide Circular No.13 of 2002, dated 31st December, 2002. The DGMS risk assessment process is intended to identify existing and probable hazards in the work environment and all operations and assess the risk levels of those hazards in order to prioritize those that need immediate attention. Further, mechanisms responsible for these hazards are identified and their control measures, set to timetable are recorded along with pinpointed responsibilities.

In the unlikely event that a consequence has occurred, disaster management kicks in. This includes instituting procedures pertaining to a number of issues such as communication, rescue, and rehabilitation. These are addressed in the disaster management plan.

Both, the RA and DMP, are living documents and need to be updated whenever there are changes in operations, equipment, or procedures

Assessment is all about preventing accidents and taking necessary steps to prevent it from happening.

Key Definitions

Hazard: Source of potential harm, injury, or loss.

Consequence: Size of the loss or damage. In terms of health and safety, it is the degree of harm that could be caused to people exposed to the hazard, the potential severity of injuries or ill health and / or the number of people who could be potentially affected. Consequence of a hazard need not only be in terms of safety criteria but could also be in terms of a money loss, incurred costs, loss of production, environmental impacts as well as public outrage.

Risk: Combination of the likelihood of a specific unwanted event and the potential consequences if it should occur.

Risk Assessment: Is a process that involves measurement of risk to determine priorities and to enable identification of appropriate level of risk treatment (used also to describe the overall process of risk management).

Risk Control: Implementation of strategies to prevent or control hazards

Risk Rating: The category or level or risk assigned following risk assessment (e.g. High, Medium or Low).

Risk Management: Overall description of the steps taken to manage risk, by identifying hazards and implementing controls in the workplace.

Emergency: A situation of process deviation that, if uncontrolled, may lead to a major accident /disaster with potential short term and/or long term risk damage consequence to life and property in and/or around the workplace.

Disaster: A catastrophic consequence of a major emergency / accident that leads to not only extensive damage to life and property, but also disrupts all normal human activity for a significant period of time and requires a major national and / or international effort for rescue and rehabilitation of those affected.

Scope of Work for RA & DMP Study

The scope of work has been framed as per DGMS requirements for risk and safety studies in mines and includes the hazard identification, risk assessment, and ranking, resulting in treatment controls and action plans.

Level 1: Hazard Identification

Hazard identification includes:

STUDY OF SAFETY ISSUES PERTAINING TO THE PROJECT

- Study of operational information, including safety concepts used in design of equipment and storages.
- Listing of hazardous inventory and identification of key hazardous substances to be used.
- Available procedures and the extent to which they are followed in operational mines by the same organization.
- Consultations with employees who carry out or are likely to carry out the jobs.
- Safety statistics for this and other mines, as applicable and available.
- Statutory mine inspection reports, where available.
- Past history of accidents and near misses.

The above are applicable to all the aspects of the mining activities including winning of minerals, crushing – sizing and transport.

IDENTIFICATION OF HAZARD SCENARIOS

Identification of scenarios that can cause damage to life & property.

Level 2: Risk Assessment & Ranking

RISK ASSESSMENT

As defined earlier, risk is a function of likelihood and consequence. Likelihood is the chance that the hazard might occur. Since the risk of any hazard is dependent upon the chance that it will occur (likelihood) and the impact of an occurrence (consequence):

Risk Score = Likelihood x Consequence

In some cases personnel are only exposed to the hazard for part of the time. Hence, a more detailed analysis of the risk ranking can be carried out by taking exposure (% time personnel are present) and probability (chance that they will be injured) into consideration. Thus:

Risk Score = (Probability x Exposure) x Consequence

The values used for likelihood, consequence, exposure or probability need to be agreed by the risk assessment team, and there is an element of professional judgment in exercising these choices.

RISK RANKING

Risk ranking can be determined by qualitative and quantitative means. It should however be remembered that no one method is best. The best choice of method will depend on the circumstances and preferences at the mine, at the time the exercise is done. However, regardless of the method establishing risk ranking will set priorities for Hazard control. The most important purpose in hazard identification, risk assessment, and ranking is to draw up and implement plans to control these hazards. However, keeping the acceptance of the participants during workshops conducted at different mines, DGMS has suggested a criteria table for quantitative risk ranking to be used as in Table 7.1.

Table 7.1: Risk ranking criteria

Scale for consequence	Scale for exposure	Scale for probability
Several dead: 5	Continuous: 10	May well be expected: 10
One dead: 1	Frequent (daily): 5	Quite possible: 7
Significant fatality chance: 0.3	Seldom (Weekly): 3	Unusual but possible: 3
One permanent disability/ less chance of fatality: 0.1	Unusual (Monthly): 2.5	Only remotely possible: 2
Many lost time injuries: 0.01	Occasional (Yearly): 2	Conceivable but unlikely: 1
One lost time injury: 0.001	Once in 5 years: 1.5	Practically impossible: 0.5
Small injury: 0.0001	Once in 10 years: 0.5	Virtually impossible: 0.1
	Once in 100 years: 0.02	

On the basis of the above scoring format, and after a perusal of the resultant scores, professional judgment was exercised in selecting the following scale for assessing risk levels:

- Level 1: > 15; i.e., requiring immediate action
- Level 2: <15 but > 5; i.e., requiring management action
- Level 3: < 5; i.e., low risks requiring periodic review

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 &

flooding).The mechanisms due to which hazards (coming under Risk Levels 1 & 2) may actually occur are covered in Table 7-2.

Table 7.2: Cause analysis for level 1 & level 2 hazards

S.No.	Hazard Description (Risk)	Risk Level	Cause Analysis
1	Travel in moving vehicle in uneven terrain	Level 3	• Poor visibility • Incompetent driver • Poorly maintained vehicles
2	Unintended explosions (exposure to overpressure)	Level 1	• Defective explosives • Outdated 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)	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)	Level 3	• Poor access control of blast area • Poor blasting practices (leading to excessive fly rock)
5	Rock falls or slide due to lack of bench face stability (bodily injuries)	Level 1	• Improper design of bench • Force Majeure (such as heavy floods or rainfall) • Improper blasting practices • Incompetent blasting personnel
6	Hit by Machineries – Electrical Equipment (bodily injuries)	Level 2	• Improper design of equipment • Improper maintenance • Non usage of required PPE. • Incompetent Personnel
7	Vehicle Accident (bodily injuries)	Level 1	• Head on collision between vehicle and another vehicle (due to poor visibility or incompetent drivers) • Poor vehicle maintenance
8	Accidental 1fire in vehicle (bodily injuries, exposure to heat radiation)	Level 3	• Accident to vehicle carrying fuel, and subsequent ignition of spilt fuel • Improper storage of fuel, in MS drums, leading to spillage followed by ignition • Driving with loaded material on • uneven terrain, and subsequent ignition of spilt fuel

7.3 Controls and Action Plans

To ensure that causes leading to the possible consequences are prevented from occurring, control and action plans are developed and suggested as described in Table 7-3. It is required that these control and action plans be implemented and reviewed at least annually and also when there are changes to the work plan.

Table 7.3: Control & Action Plan

S. No	Hazard	Causes	Control	Relevant Legislation	Procedure	Existing Procedure (Y/N)	Responsible Person (Designation)
1	Unintended explosions (exposure to over pressure) during storage of explosives in magazines	Defective explosives	Explosive used should be purchased only from approved and licensed authority If deteriorated or unserviceable explosive is found, seek advice of licensing authority	Metalliferous Mines Regulation – 1961. & Explosive act, 1884	If any defective explosive is found, it is returned back to the original supplier for disposal at their end as per Rule 16 of The Explosive Rules 1983	Y	Authorized supplier of explosives
		Outdated explosives	Records and accounts of explosive stock and issue is to be maintained Stock should be drawn upon strict rotation Well planning for requirement of explosives shall be exercised Disposal of outdated explosives as the chief controller or controller of explosive may issue	Explosive act, 1884,MMR – 1961.	Maintaining registers for Explosives receipt, issue and stock as per Reg. 154, 156 of MMR 1961.	Y	Mines Manager
		Improper storage of explosives	Detonator are to be stored separately Explosives shall be stored in dry and well ventilated area Protect explosives from extreme temperatures	Explosive act, 1884,	Explosives and Detonators are stored separately as per approved design & licensed capacity of magazine under Explosive act, 1884	Y	Mines Manager

		Force majeure conditions such as lightning strike	Lightning conductor are to be installed on the top of magazine Lightning conductor should not have resistance more than 10 ohms	The Explosive Rules 1983	Lightning arrestors are provided and maintained as per the requirement under Rule 116 the Explosive Rules 1983	Y	Mines Manager
		Fire (can be caused by unsafe practices or as arson)	Empty packages shall be removed immediately and destroyed. No smoking or any source of light or fire shall be allowed near explosives storage	The Explosive Rules1983 MMR - 1961	Follow the instructions Specified in Rule 154, 156 and 170 of MMR – 1961 for storage, and handling of Explosives. Rule 97and 101 of the ER 1983	Y	Mines Manager, Mines Foreman (Blasting)
		Sabotage	Security shall be provided at the magazine Shortage and theft of explosive shall be reported to the nearest police station and the licensing authority	The Explosive Rules,1983,	Round the clock security guards provided and immediate reporting to nearest Police Station and Licensing Authority done in case of thefts or sabotage as per Rule – 123 of ER 1983	Y	Mines Manager
2	Rock falls or slide due to lack of bench face stability (bodily Injuries)	Improper design of bench	Proper catch bench design and proper blasting pattern reduces over break Maintain the width to height ratio as per DGMS	MMR-1961	Procedure for opencast working as per Reg. 106	Y	Mines Manager
		Force Majeure (such as heavy floods or rainfall)	Dewatering or culverting the storm water may reduces slides of bench	MMR-1961.	Following procedures as per Reg. 127 and 130 of MMR –1961 for Dewatering or and culverting the	Y	Mines Manager

					water		
		Improper blasting practices	Good design of blasting network is important to reduce rock fall and slides of bench face	MMR-1961.	Procedure for opencast working as per Reg. 106	Y	Mines Manager
		Incompetent blasting personnel	Shot firer should have shot firer's permit granted under explosive rules	MMR - 1961	Appointment of Shot firer as provided in Reg. 160 of MMR 1961	Y	Mines Manager
3	Vehicle accident (bodily injuries)	Head on collision between vehicle and another vehicle (due to poor visibility or incompetent drivers)	Haul road should be sprinkled Regularly Driving at night shall be avoided Driver should be RTO licensed holder for driving vehicle	MMR – 1961 Motor Vehicle Act	Sprinkling of water in haul road as per Reg. 124 MMR 1961 and appointment of RTO licensed drivers	Y	Mines Manager
		Poor vehicle maintenance	Periodic servicing of vehicle Brakes and steering apparatus should be in good condition Headlight and tail light of the vehicle should be in good condition	MMR 1961	Procedure for Maintenance of Vehicles under Reg. 176 of MMR - 1961	Y	Mines Manager

4	Unintended explosion or exposure to overpressure, charging blast holes	Poor access control of blast area	Well planning is required before and after charging of blast holes. Blast sites should be secured and warning signs posted before loading boreholes.	MMR 1961	Procedure for drilling charging stemming and firing of holes as per Reg.162	Y	Mines Manager
		Incompetent blasting personnel	Shot firer should have shot firer's permit granted under explosive rules	MMR 1961	Appointment of Shot firer as per Reg. 160 as per MMR 1961	Y	Mines Manager
		Poor blasting practices	Tamping rod of wood must be used, iron or steel rods should not be used. No smoking or any source of light or fire shall be allowed near explosives storage. Before loading the blast hole blaster should check the driller log Blast sites should be secured and warning signs posted before loading boreholes.	MMR – 1961 - The Explosive Rules, 1983,	Procedure for drilling charging stemming and Firing of holes as per Reg. 161, Rule 14 of ER ISO procedure QSP- 760-06	Y	Certified Blaster
		Defective explosives	Explosive used should be purchased only from approved and licensed authority only If deteriorated or unserviceable explosive is found, seek advice of licensing authority	The Explosive Rules, 1983	Explosive are purchased from Approved manufactured or authorized license holder from CCE.	Y	Mines Manager

		Outdated explosives	Stock should be drawn upon strict rotation	The Explosive Rules 1983	Issue of explosives on first come first ISO procedure QSP- 760-06	Y	Mines Manager
5	Hit by fly rock (bodily injuries) During blasting	Poor access control of blast area	Adequate blast area security must be provided. Blast sites should be secured and warning signs posted before loading boreholes. Post guards at the access points to prevent unauthorized entry	MMR – 1961	Procedure for tacking shelter etc. during drilling and blasting Reg. 164 of MMR 1961	Y	Mines Foreman (Blasting)
		Poor blasting practices (leading to excessive fly rock)	Burden, spacing, hole diameter, stemming, sub drilling, initiation system, and type of explosive used matched the characteristics of the rock formation. Adequate blasting Shelter must be used for the persons whose presence is required in blasting Nobody should be present within 300 m radius of blasting site as per DGMS circular except blasting personnel. Practice for controlled blasting Technique with milli-second delay detonators/ electric shock tubes/ cord relays. Training of persons and their helpers engaged in such	DGMS/(Tech) Cir.No.2 of 2003	Procedure for drilling and blasting, tacking shelter etc. as per Reg. 164 MMR1961, DGMS (SOMA)/(Tech) Cir.No.2 of 2003	Y	Certified Blaster (MMR)

			blasting operation.				
6	Hit by Machineries – Electrical Equipment (bodily injuries)	Poor machinery Maintenance	Periodic servicing of machineries Periodic Inspection / Audit of Machineriesand Structures Non Compliance to SOP	MMR 1961	Procedure laid under Section 174 Chapter XVI – Machinery and Plant of MMR 1961	Y	Mines Manager
		Poor Cabling / Earthling To Rotating Equipments	Periodic servicing of electrical instruments. Periodic Inspection / Audit of Electrical equipments – cables and accessories Non Compliance to SOP	Indian Electricity Rules 2003	Section VII – Works of Licensees of Indian Electricity Rules 2003	Y	Electrical In charge under Mines Rules 1951

First Aid

First aid facility will always be made available to time mine site with well-maintained first aid box. A separate van will also be made available at the site which will deliver the employ to the nearest health center in case of any miss-happening.

Community Development Policy:

Corporate Environment Responsibility

As per the primary analysis and secondary data available the mine site is located in a remote location with scanty of available social infrastructure available. The break-up of CER is tabulated below:

Sr. No.	Activity	Cost in Rs. (in Lakhs)
1.	Construction of Community Toilets	1,00,000
2.	Solar Street Lighting in village	20,000
3.	1 Hand-Pump	50,000
	Total	1,70,000

Apart from the motioned activity other suggested activities will be:

- ✓ Medical Camps will be organized for the employees of the project and for the people in the nearby area of mine lease area. It will be done with coordination of the Government Hospital in the nearby area whose equipment facilities can be used for this purpose. Medicines will be provided free of cost.
- ✓ First aid training will be regularly imparted to trainees from the neighboring villages.
- ✓ The Company also distributes saplings to the local villagers as a part of social forestry.
- ✓ Give financial assistance for construction work in schools, for community Centre etc. through gram panchayat.

Give financial assistance to Government Hospitals for their modernization and purchase of required equipment.

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