ANNEXURE XIII

Hazards Indentification and Risk Assessment Plan of Hatgacha Black Stone Mining Project

West Bengal Mineral Development & Trading Corporation Ltd.
(A Government of West Bengal Undertaking)

Village: Hatgacha, P.O: Bharkata, P.S: Md. Bazar, District: Birbhum- 731216

Introduction:

Hazard identification and Risk Assessment is a formal process involving the study of work activities, carried out as to:

a. **Identifying hazards, which are the potential causes of harm.**
   A hazard is defined as "*means a source of or exposure to danger*". When assessing all hazards employers would be required to assess all tasks performed or machines / equipment used;

b. **Assessing the risks for each tasks evaluated.**
   Risk is defined as "*means the probability that injury or damage will occur*". When assessing the risk associated with the task performed the Risk Rating Sheet could be used.

c. **Deciding on suitable measures to eliminate or control measures to be implemented.**
   The Occupational Health and Safety Act, 1993 and incorporated Regulations regard the issuing of personal protective equipment as the last resort. Employers should therefore first attempt to mitigate the hazards identified;

d. **Recording the information**.
   Without any record of HIRA's conducted the employer would not be able to prove compliance. The format of the Risk assessment report is not prescribed.

e. **Implementing control measures as to ensure that the workplace is as safe as what would be reasonable practicable.**
   Reasonably Practicable is defined as" means practicable having regard to:

   i. The severity and scope of the hazard or risk concerned;

   ii. The state of knowledge reasonably available concerning that hazard or risk and of any means of removing or mitigating that hazard or risk;

   iii. The availability & suitability of means to remove or mitigate that hazard or risk; and

   iv. The cost of removing or mitigating that hazard or risk in relation to the benefits deriving there from.

Table No. 1: Location & Accessibility of Hatgacha Black Stone Mining Project

Sl. No.	Particulars		Description
2.1	**Lease area and land use.**		The mining lease hold area over 108.53 acres or 43.94 Ha is only non-forest land.
2.2	**Location with map**	Toposheet no.	G45V12 – Earlier 72 P/12.
		Latitude:	24°6'54.599"N–24°7'16.822"N
		Longitude:	87°35'20.336"E – 87°35'52.315"E
2.3	**Ownership /occupancy**		Most of the lands are tenanted /rayati in nature. Working lands are in possession of WBMDTC Ltd.
2.4	**Topography of the area**		The elevation ranges from 71 m AMSL to 97 AMSL. The area in general posses a flat topography with gently sloping towards north.
2.5	**Existence of public roads/railway lines if any, and approx. Distance.**		Hatgacha Black Stone Mining Project is situated 8 km. north of Sotsal. Sotsal is located 23 km. away from Suri, the District Headquarters of Birbhum, on Suri — Rampurhat main road. All weather 9km long road connects the mines with Ganpur which is on NH- 60. NH- 60 runs from the junction with NH-5 at Balasore to junction with NH- 34 at Moregram. Nearest railway station is at Mollarpur. The nearest Railway Station, Mollarpur, on Sahibgunj Loop of Eastern Railway is 17km away from the project. The project is well connected with Sotsal with all weather metalled road and also connected with wide network of State and National Highways.

Details of the area:

Lease Area– 108.53 acres or 43.94 Ha.

Table No. 2 : Details of the area

District	P.S	Mouza/Village	J.L. No.
Birbhum	Mohammad Bazar	Hatgacha	01

Table No. 3 : Mouza Wise Plot Numbers

Mouza	JL No	Plot Nos
Hatgacha	01	146(p), 225, 226, 228, 229, 231 to 234, 288 to 319, 331, 946 to 959, 1050 to 1069, 1072, 1073, 1252 to 1257, 230, 316/5206 to 316/5210, 1915/5546.

As per the land record, all plots are non forest in nature.

Safety Management Plans:

The Safety Management Plan is a working document, which outlines all of the actions to be carried out to ensure the safety and health at the work place.

Objectives of Safety Management Plan:

- The Safety Management Plan established by a mine must ensure all risks are identified and critical risks are controlled to ensure long-term health and safety.
- A Safety Management Plan should set the culture, framework and actions necessary to ensure that mining operations are carried out safely.
- Emergency Preparedness to cope with a hazard if it should occur.

STRUCTURE OF THE SAFETY MANAGEMENT PLAN:

- Strategic
  - Have policies made by the organization that ensures health and safety.
  - Delegate organizational responsibility to appropriate levels.
  - Discuss with committees to implement safety improvements.

- Management
  - Implementing and managing site-specific Safety Management Plans.
  - Identification of major hazards and assessment of risks.
  - Providing appropriate guidelines, directives and training.

- Operational
  - Assess risks associated with each step of all work.
  - Follow safe operational processes and procedures.
  - Actively participate in safety committees and continuous improvement.

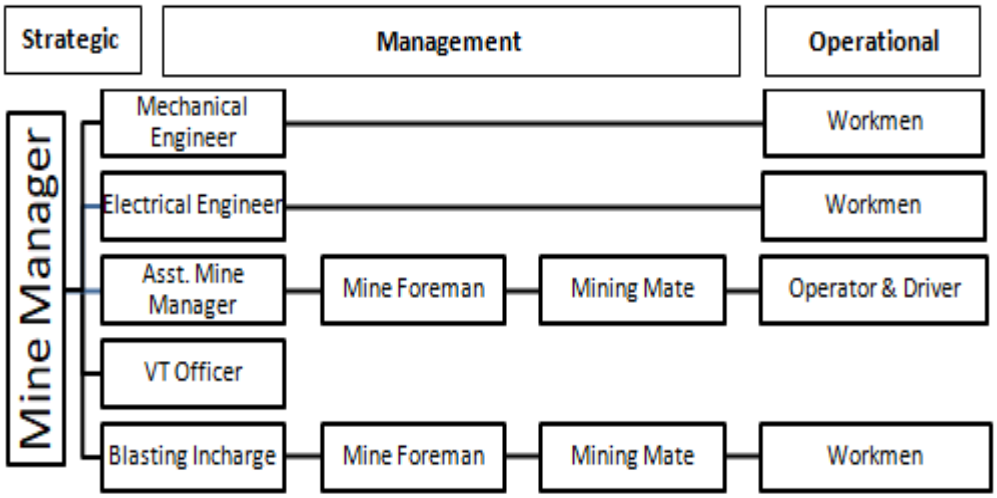

Figure No.1

TOOLS TO IMPROVE SAFETY MANAGEMENT PLAN

Safety Committee:

The Safety Committee can have a significant role in effective Safety Management Plan. It contains representatives from all aspects of the mine, with a focus on ensuring and improving health and safety in the workplace. Whilst the committee's function is well defined in the Mines Rules, the Safety Plan needs to outline the operation of the Safety Committee to ensure committee members and the mines workforce are quite clear on its role, its responsibilities and objectives.

- Key Responsibilities of the Committee to:
- Improving health and safety in the workplace
- Reviewing accident / incident reports & statistics
- Identify hazards & the review of action plans
- Implementing & managing the Plan

The management of the mine should conduct a risk assessment process to identify any hazard that could influence the safety and health of workers of the mine. For all hazards that pose a potential chance of multiple fatalities at one time and are not fully controlled, a Hazard Management Plan must be drawn up. To operate mines safely all hazards must be quickly identified and controlled. Using a risk ranking process can assist mine staff to identify the highest risk hazards for attention. This process is summarized below.

- Identify hazards
- Assess the risks posed by these hazards (risk ranking)
- Control or treat hazards to reduce unsafe or unhealthy situations

This technique should be used to assist effective management of safety in the workplace within the Safety Management Plan. It should be noted that Hazard Identification and Risk Assessment should not be considered to be a once off occurrence but should be done at regular intervals to ensure that the plans to cope with the identified hazards are pertinent and up to date.

Codes of practice (COP):

Code of practice may prepared and implement on any matter affecting the health or safety of employees and other persons who may be directly affected by activities at the mine. It must comply with guidelines issued by the Chief Inspector of Mines. On the preparation, implementation or revision of any code of practice, suggestion should be taken from the health and safety committee.

Safe Operating Procedure (SOP):

It outlines a process to assist with the development of workplace-specific Safe Operating Procedures (SOP) for plant, equipment, hazardous chemicals, work tasks and processes that have the potential to cause harm to persons, plant, material or the environment as identified from risk assessments. SOPs should be written with sufficient detail to ensure that someone with limited experience or knowledge of the procedure, but with a basic understanding, can successfully carry out the procedure in a safe manner when unsupervised. They should be written in a concise, logical, step-by-step, easy-to-read format.

Induction & Training:

Each mine will have training programs for employees, which need to be reviewed against safety criteria. The updating of training requirements should include re-training of existing personnel to the new skill level. This can be performed on-the-job. When the new skill, procedure, etc. has been taught to an individual and they have been assessed to have achieved that Competency. In some instances, staff should be prevented performing tasks until they have been correctly trained in new procedures and are considered competent to perform a task safely.

Auditing & Review/Revise:

Auditing & Reviewing are the effectiveness of programs within the Safety Management Plan. This should be an on-going process. Auditors need training to be objective and independent. Management Team or the Health and Safety Committee would have to decide how often audits would be done, what systems or areas would be audited and reporting arrangements.

Table No. 4 : Proposed Safety Management Plan for Hatgacha Stone Mining Project

Tools	Frequency	Responsible Person	Responsibilities
Audit	Yearly	Auditor	○ Prepare report by review the health & safety related statistics. ○ Report to Managing Director.
Safety Committee	Monthly	• Mine Manager • Assistant Mine Manager • Mine Foreman • Mining Mate • VT Officer • Electrical Engineer • Mechanical Engineer • Excavator Operator • Dumper Operator • Drill Operator • Electrician • Mechanic	○ Improving health and safety in the workplace. ○ Reviewing accident / incident reports & statistics. ○ Discuss & make guideline for COP & SOP. ○ Implementing control managing plan after risk assessment. ○ Reporting responsibilities.
Hazard Identification & Risk Assessment	Half yearly	Safety Committee members	○ Hazards identification. ○ Risk scoring. ○ Risk ranking. ○ Control measure to reduce risk. ○ Review.
Codes of practice (COP)	Quarterly	Safety Committee members	○ Preparation / review
Safe Operating Procedure (SOP)	Quarterly	Safety Committee members	○ Preparation / review
Induction	As required	V T Officer	○ To give induction training.
Training	Half yearly	V T Officer	○ Arrangement for training class. ○ Issuing certificate.

Hazard Identification:

Hazard analysis involves the identification of hazards at a facility and evaluating possible scenarios leading to unwanted consequences. The hazard analysis stage is a very important part of the risk management process, as no action can be made to avoid, or reduce, the effects of unidentified hazards. The hazard analysis stage also has the largest potential for error with little or no feedback of those errors.

There are several hazard identification techniques. Out of available techniques we have selected Preliminary Hazard Analysis to identify the hazards in this mining process. Major Hazards identified would include the following;

- Fly-rocks during blasting
- Toppling of heavy equipment
- Explosion in magazine (explosive storage)
- Fire in fuel (HSD) storage /handling
- Waste dump failure
- Fire in mine equipment
- Landslide (Slope failure)
- Electrical Fire
- Hanging of unsupported rock mass on the working face of the mine.
- Blasting is not done by an authorised person.

Apart from the above there are other hazards which can have serious impacts on the health of workmen. They include the following.

- Exposure to dust, chemicals and hazardous substances
- Hazards due to gravitational energies acting on unsafe stockpiles, structures, excavated pits etc.
- Hazards due to unsafe handling /driving or failure of mobile mechanical equipment.
- Hazards due to fixed mechanical equipment due to unsafe acts or conditions.
- Hazards posed due to unsafe work environment like higher noise level, slips /tripe, vibration etc.

The risk analysis mentioned below has included all these hazards systematically.

Risk Assessment

Types of Risk Assessments:

Risk assessments to be conducted can be divided into the following three types;

a). Baseline Risk Assessments:

A Baseline Risk Assessment would be conducted if no previous Risk Assessment has been conducted. This Risk Assessment report should reflect information on:

i. All workplaces;
ii. All activities or tasks performed; and
iii. All machinery or tools used.

The frequency at which these Risk Assessment reports should be reviewed is not prescribed. It is however common that annual reviews are required;

b). Issue Based Risk Assessments:

These Risk Assessments are typically conducted:

i. After a new machine was purchased - The purpose of this assessment is to determine if the machine is safe and in compliance with legal and other requirements;

ii. After an incident - During the incident investigation process, weaknesses with internal policies or procedures could have been identified. The incident investigation may also show additional precautionary measures are required to prevent a re-occurrence;

iii. When new legislation was promulgated - New legislation may prescribe requirements which are currently not being complied with. Assessing the contents of the legislation will show these non-conformances and will allow employers to ensure compliance;

c). Continuous Based Risk Assessments:

Regular inspections conducted on equipment or machinery such as daily inspection of mobile plant could be regarded as continues based risk assessments. The purpose of conducting continuous Hazard Identification and Risk Analysis is to:

- Identify Operational health and safety hazards with the purpose of immediately treating significant risks
- Gather information to feed back to issue-based Hazard Identification & Risk Analysis
- Gather information to feed back to baseline Hazard Identification & Risk Analysis.

Objective of Risk Analysis:

Risk analysis is done for

- Forecasting any unwanted situation
- Estimating damage potential of such situation
- Decision making to control such situation
- Evaluating effectiveness of control measures

Acceptable Risk:

Risk that is acceptable to regulatory agency and also to the public is called acceptable risk. There are no formally recognized regulatory criteria for risk to personnel in the mining industry. Individual organizations have developed criteria for employee risk & the concepts originally arising from chemical process industries and oil & gas industries.

Because of the uncertainties linked with probabilistic risk analysis used for quantification of the risk levels the general guiding principle is that the risk be reduced to a level considered As Low as Reasonably Practicable (ALARP). The risk acceptability criteria are illustrated in Figure No. 1. It can be seen that there are three tiers:

a. A tolerable region where risk has been shown to be negligible and comparable with everyday risks such as travel to work.

b. A middle level where it is shown the risk has been reduced to As Low As Reasonably Practicable Level (ALARP) and that further risk reduction is either impracticable or the cost is grossly disproportionate to the improvement gained. This is referred as the ALARP region.

c. An intolerable region where risk cannot be justified on any grounds. The ALARP region is kept sufficiently extensive to allow for flexibility in decision making & allow for the positive management initiatives which may not be quantifiable in terms of risk reduction.

- **Intolerable Region:** Risk unacceptance and must be reduced. The actions may include equipments and people or procedural measures. If risk cannot be reduced to ALARP level, operating philosophy must be fundamentally reviewed by the management.
- **ALARP Region:** Efforts must be made to reduce risk further and to as low as reasonably practicable, without expenditure that is grossly disproportionate to the benefit gained.
- **Tolerable Region:** Risk level is so low as to not require actions to reduce its magnitude further.

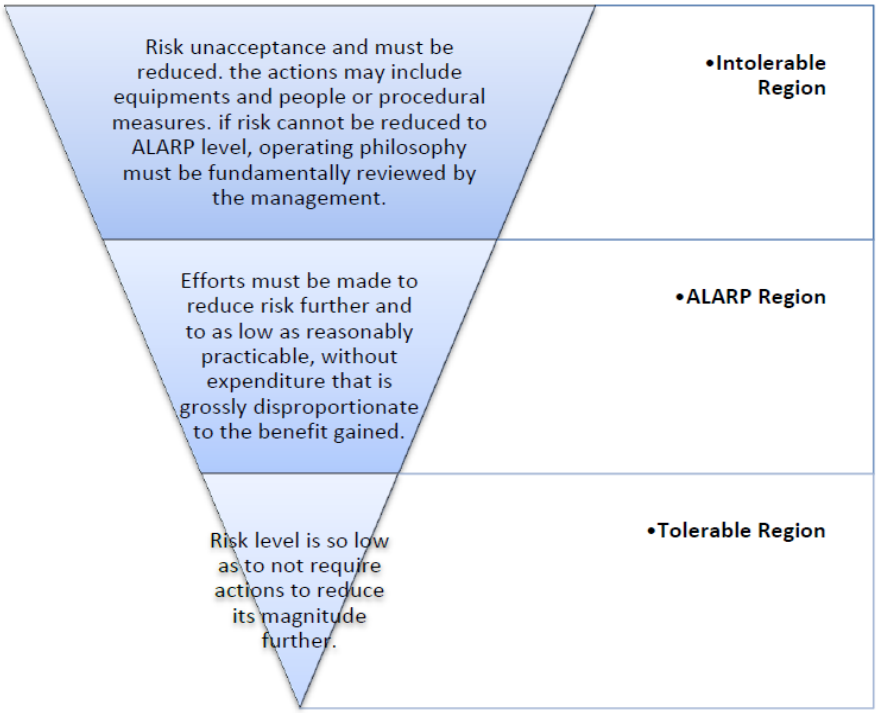

Figure No. 2: The Risk Acceptability Criteria

Methodologies for Risk Analysis –Qualitative Vs Quantitative

The objective of risk analysis is to produce outputs that can be used to evaluate the nature and distribution of risk and to develop appropriate strategies to manage risk. Events or issues with more significant consequences and likelihood are identified as “higher risk“ & are selected for higher priority mitigation actions to lower the likelihood of the event happening and reduce the consequences if the event were to occur.

Qualitative methods use descriptive terms to identify and record consequences and likelihoods of the events and resultant risk. Quantitative methods identify likelihoods as frequencies or probabilities. They identify consequences in terms of relative scale (orders of magnitude) or in terms of specific values (for example estimate of cost, number of fatalities or number of individuals lost from a rare species).

The main difference between *qualitative* and *quantitative risk analysis* is that the former uses a relative or descriptive scale to measure the probability of occurrence whereas quantitative analysis uses a numerical scale. For example, a qualitative analysis would use a scale of "Low, Medium, High" to indicate the likelihood of a risk event occurring. A quantitative analysis will determine the probability of each risk event occurring. For example, Risk #1 has an 80% chance of occurring; Risk #2 has a 27% chance of occurring, and so on.

For both qualitative and quantitative methods it is important to invest time in developing appropriate rating scales for likelihood, consequence and resultant risk. The full range of risk situations likely to be encountered within the scope of the exercise should be considered when developing rating scales.

The Black Stone Open caste mine is at the stage of EIA assessment. As such base line risk assessment is required for the mining project. Detailed information required for the Semi Quantitative and Quantitative Risk Analysis Methods are not available. As such attempt has been made here to conducting a qualitative risk assessment

Qualitative Methods

Qualitative approaches to risk assessment are the most commonly applied. Qualitative risk assessment methods are quick and relatively easy to use as broad consequences and likelihoods can be identified and they can provide a general understanding of comparative risk between risk events, and the risk matrix can be used to separate risk events into risk classes (ratings).

A logical systematic process is usually followed during a qualitative risk assessment to identify the key risk events and to assess the consequences of the events occurring and the likelihood of their occurrence.

Risk Rank Likelihood x Consequence	L1 Almost certain	L2 Likely	L3 Possible	L4 Unlikely	L5 Rare
1 Catastrophic	1	2	4	7	11
C2 Major	3	5	8	12	16
C3 Moderate	6	9	13	17	20
C4 Minor	10	14	18	21	23
C5 Insignificant	15	19	22	24	25

RISK RATING	
High Risk	1 - 6
Medium Risk	7 - 15
Low Risk	16 - 25

Figure No. 3: Qualitative Method for Classification of Risks

Table No. 5: Likely hood and consequence Table for Qualitative Risk Analysis

Step 1: Assess the Likelihood				Step 2 Assess the Consequences		
L1	Happens every time we operate	Almost Certain	Common or repeating occurrence	**C1**	Fatality	Catastrophic
L2	Happens regularly (often)	Likely	Known to have occurred "has happened"	**C2**	Permanent disability	Major
L3	Has happened (occasionally)	Possible	Could occur or "heard of it happening"	**C3**	Medical/hospital or lost time	Moderate
L4	Happens irregularly (almost never)	Unlikely	Not likely to occur	**C4**	First aid or no lost time	Minor
L5	Improbable (never)	Rare	Practically impossible	**C5**	No injury	Insignificant

Qualitative approaches are best used as a quick first-pass exercise where there are many complex risk issues and low-risk issues need to be screened out for practical purposes. Qualitative approaches have some shortcomings compared with more quantitative approaches. Key criticisms are that qualitative methods are imprecise it is difficult to compare events on a common basis as there is rarely clear justification of weightings placed on severity of consequences and the use of emotive labels makes it difficult for risk communicators to openly present risk assessment findings.

Hazard Identification & Risk Assessment of Black Stone Mine at Hatgacha

The Black Stone Mine is located in Hatgacha villages in Birbhum District of West Benga, India. Mining operations are to be carried out in a series of 6 meter high benches; 110mm diameter holes are deep drilled and blasted with explosives; the stone is then shovelled and trucked. The mine has facility for crushing and screening of the stone in a crusher plant of 200 TPD capacity to prepare different grades of aggregates. The total lease area of the mine is 71.20 ha and the lease was obtained on 16/12/2010. The lease area does not have any forest cover. The black stone mine aims to produce a maximum aggregates of 0.8 million TPA and +12mm sizes. To have risk assessment of the mining process the following information is recorded:

- Topographic data,
- Geological data
- Location data
- Mining methodology
- Machineries deployed

- **Topography Data –** it is an essential component as it gives an idea about the surrounding environment of the deposit. At Black Stone Mine the entire area is having a flat topography and the general slope of land is towards north. There is no river flowing through this area; however a perennial nala flows from south to north in the western part of the mine lease area with one of its tributaries.

- **Geological Data –** it gives an idea of the kind of the deposit that is available and the nature of OB on the area and also faults or discontinuities if present any. In the black stone mine represent a vast spread of basalt of Rajmahal Volcanic. The sevolcanic rocks are believed to be of middle Jurassic to lower Cretaceous age. Rajamahal volcanic rocks include thick sequence of basalt and intertrapen sediments. The maximum thickness of the Rajmahal volcanic site is of the order of 330m. However, it shows a decrease in thickness towards south near the eastern periphery of Raniganj coal field where it attains a thickness of 100m. The intertrapen horizon varies in thickness from 1m to 26m and even greater thickness has been recorded.

Geological survey of the study area reveals the following sequence of formations;

1st Layer - Soil/Aluvium
2nd Layer - Basalts
3rd Layer – Intertrapean
4th Layer - Massive Basalts

However, the thicknesses of these layers vary from location to location. The thickness of top layer i.e. alluvium vary from 5m-8m,2nd layer from 80m-130m, the third layer i.e. Intertrapean from 26m-70m.This is followed by massive basalt.

Mining Method

In the Hatgacha black stone open cast mine semi-mechanized method of mining would be adopted. Since the deposit is sub-horizontal or almost flat as per evidence of nearby mines /quarries haul road of about 6m width with 3m height shall have to be made from the ground level to the bottom of the pit. Thos haul road has been designed 1:16 or even less gradient for a total length of 1300m and width at last three times the width of the dumper so that two dumpers may move up and down simultaneously from the pit bottom to ground surface carrying black stoneor waste/overburden/top soil etc.

The mining operations are achieved with the help of shovel dumper combination. The bench height of 6m is kept and drilling is done by 110 mm diameter drills with 10% sub-grade drilling. Blasting is done by using mostly SME (Site Mixed Emulsion Explosives) with the Nonel system of initiation so as to minimize adverse effect on environment such as ground vibration, noise and fly rock. The blasted material is loaded by shovels of different capacities into 28 tons tippers.

The Black stone from mine faces is carried to weigh bridge and then unloaded at Stock yard for crushing to different sizes in the crushing plant. During crushing of black stone there will be generation of dust which shall be admixed with OB material/soil for dumping in the construction of earthen embankment in the west of the lease area.

Machinery Deployed

The detail of the HEMMs used at black stone mine are given below. Dumpers of 28T capacity would be used. The drills used are electrically operated whereas the shovels are diesel operated.

Table No. 6: Machinery Deployed in the Blackstone Mine

Machinery	Capacity of Each Unit	Number of Units
Drill with Compressor – Wet drill accessories	4" dia or 110mm dia	2 nos.
Hydraulic Excavator /Backhoe	2.5 cum	2 nos.
Hydraulic excavator /Backhoe	2.0 cum	1 no.
Front End Loader	2.0 cum	1 no.
Rock Breaker	--	1 no.
Bull Dozer	180 HP	1 no.
Tippers	28 Tonnes	18 nos.
DG Set	500 KVA	1 no.
Jeep	--	2 nos.

Risk Analysis and Risk Management :

The steps we would be following for risk assessment and risk management in the black stone open caste mines are as follows:-

- Hazards identification
- Ranking of hazards as per their probability and consequence
- Management of hazards as per their ranking

Major risks that were identified were related to

- Fly-rocks during blasting
- Toppling of heavy equipment
- Explosion in magazine (explosive storage)
- Fire in fuel (HSD) storage /handling
- Waste dump failure
- Fire in mine equipment
- Landslide (Slope failure)
- Electrical Fire

As per the risk analysis carried out in black stone mine, few major risks as per the ranking are;

- Hanging of unsupported rock mass on the working face of the mine.
- Blasting is done by an unauthorized person.

Risk Rating

Table No. 7: *Dust, Chemicals and Hazardous Substances*

Hazard Type	**Likelihood Level**	**Maximum Consequence**	**Risk Rating**
Dusts that can effect health such as silica	L4	C3	17
Other dusts that can effect operations	L4	C3	17
Chemical such as petrol, diesel, oils, degreasers, solvents	L4	C4	21
Chemical fumes such as from welding/ cutting, grinding, etc	L3	C5	22
Gases such as H_2S, CO, CO_2 NO_X	L4	C5	24
Fines or build-up of combustible particles	L4	C5	24

Table No. 8: *Explosives*

Hazard Type	**Likelihood Level**	**Maximum Consequence**	**Risk Rating**
Unauthorised person firing shot	L3	C1	4
Handling Explosives	L4	C1	7
Explosives – general (Fly rock occurrences, noise & vibrations, in neighbourhood)	L4	C1	7
Explosives Storage -including detonators	L5	C1	11

Table No. 9: *Gravitational Energies*

Hazard Type	**Likelihood Level**	**Maximum Consequence**	**Risk Rating**
High wall / pit wall / stockpiles / berms	L3	C1	4
Fall and dislodgement of earth and rock	L4	C1	7
Instability of the excavation & adjoining structures	L4	C1	7
Floor	L4	C3	17
Mine road design and construction	L4	C3	17
Objects / structures falling on people	L4	C3	17
Fall of things such as components, tools, structures	L5	C3	20
Air blasts / wind	L3	C5	22

Table No. 10: ***Mechanical Energies***

Equipment such as earth moving machinery (trucks, loaders, dozers, etc.), rail, winders, mining equipment such as drills, shovels, excavator, other Hazard Type	**Likelihood Level**	**Maximum Consequence**	**Risk Rating**
Inappropriate exposure to moving machinery	L4	C2	12
Mechanical failure (including critical systems)	L3	C3	13
Loss of control of a vehicle or other machinery at the mine	L4	C3	17
Road traffic in and out issues	L4	C3	17
Interaction between mobile plant & pedestrians	L4	C3	17
Unintentional fire or explosion	L4	C3	17
Contact of mobile plant with overhead structures	L5	C3	20

Table No. 11: Fixed Mechanical Equipment such as Conveyor, Crusher, Screens, Others

HAZARD TYPE	**Likelihood Level**	**Maximum Consequence**	**Risk Rating**
Means of prevention, detection and suppression of fires	L4	C1	7
Inappropriate access to operating machinery (e.g. Guards missing)	L4	C2	12
Mechanical failure (including critical systems)	L3	C3	13
Conditions under which plant is use	L4	C3	17
Safe access/procedures	L4	C4	21
Blockages and spillage	L4	C5	24

Table No. 12: ***Pressure (Fluids/Gases)***

HAZARD TYPE	**Likelihood Level**	**Maximum Consequence**	**Risk Rating**
1. Unusual rain event	L3	C3	13
2. Inrush into/flood intrusion of mine (directly or indirectly)	L5	C3	20
3. Road drainage	L4	C5	24

Table No. 13: *Work Environment*

HAZARD TYPE	Likelihood Level	Maximum Consequence	Risk Rating
Noise	L4	C2	12
Manual handling hazards	L4	C3	17
Wildlife such as snakes, spiders, insects	L4	C3	17
Biological, such as exposure to work related diseases	L4	C3	17
Slip/trip hazards	L4	C4	21
Vibration	L4	C4	21
Building maintenance / cleaning	L3	C5	22
Effects of Ventilation	L5	C4	23
Condition of Buildings / Structures	L4	C5	24
Sufficient Hygiene Facilities	L4	C5	24

Table No. 14: *Others*

HAZARD TYPE	Likelihood Level	Maximum Consequence	Risk Rating
1. Use of PPE	L5	C1	11
2. No dust suppression after blasting	L1	C4	10

Risk assessment is to be performed on a regular basis. The goal for each risk assessment session is to identify hazards, determine risk ratings and controls, and to review the implementation of risk controls from previous risk assessment sessions. A team approach is recommended to establish hazards in the workplace. The risk of any hazard is dependent upon the chance that it will occur (likelihood) and the impact of an occurrence (consequence).

Table No. 15

Sl. No.	Particulars	Description
1	**Hazard**	Source of potential harm, injury or loss.
2	**Risk**	Combination of the likelihood of a specific unwanted event and the potential consequences if it should occur.

3	**Consequence**	Consequence is the 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.
4	**Likelihood**	Likelihood is the chance that the hazard might occur.
5	**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).
6	**Risk Control**	Implementation of strategies to prevent or control hazards.
7	**Risk Rating**	The category or level or risk assigned following risk assessment (e.g. High, Medium, Low etc.)
8	**Risk Management**	Overall description of the steps taken to manage risk, by identifying hazards and implementing controls in the workplace.

Using the equations the following values can be used to calculate 'Risk Score' for a Hazard.

Risk score = Consequence x Likelihood

Risk score = Consequence x Probability x Exposure

Table No. 16

Sl. No.	**Particulars**	**Description**	
1	**Scale for consequence**	Several dead	5
		One dead	1
		Significant chance of fatality	0.3
		One permanent disability / less chance of fatality	0.1
		Many lost time injuries	0.01
		One lost time injury	0.001

		Small injury	0.0001
2	**Scale for exposure**	Continuous	10
		Frequent (daily)	5
		Seldom (Weekly)	3
		Unusual (Monthly)	2.5
		Occasional (Yearly)	2
		Once in 5 years	1.5
		Once in 10 years	0.5
		Once in 100 years	0.02
3	**Scale for probability**	May well be expected	10
		Quite possible	7
		Unusual but possible	3
		Only remotely possible	2
		Conceivable but unlikely	1
		Practically impossible	0.5
		Virtually impossible	0.1

The process of identifying hazards is possibly the most important part of the whole risk assessment process. An assessment team shall be formed at Hatgacha Black Stone Mining project for hazard identification and risk assessment.

Table No. 17: Assessment Team of Hatgacha Stone Mining Project

Sl No	DESIGNATION
1	Mine Manager
2	Assistant Mine Manager
3	Mine Foreman
4	Mining Mate
5	VT Officer
6	Electrical Engineer
7	Mechanical Engineer
8	Excavator Operator

9	Dumper Operator
10	Drill Operator
11	Electrician
12	Mechanic

Table No. 19 : Facilitator

Sl No	DESIGNATION
1	Agent & G.M (Non-Coal)

Risk Treatment

- All safety precautions and provisions of Metalliferous Mine Regulations (MMR) 1961 shall be strictly followed during all mining operations.
- Entry of any unauthorized person into mine and plant areas shall be completely prohibited.
- Arrangements for fire fighting and first-aid provisions in the mine's office complex and mining area.
- Provision of all the safety appliances such as safety boot, helmets, goggles, ear plugs etc. shall be made available for the employees.
- Mining will be undertaken in coexistence with the requirements of the Mining Plan which shall be updated from time to time.
- Mine faces shall be regularly cleaned so as to ensure that the same is safe to work
- Handling of explosives, charging and blasting shall be undertaken only by a competent person.
- Adequate safety equipment shall be provided at the explosive magazine.
- All the mining equipment shall be maintained as per the guidelines of the manufacturer.
- Haul roads shall be water sprinkled in order to suppress dust and other fugitive emission.
- Elevating the awareness of employees, contract workers and public as a whole by celebrating Annual Safety Week which includes various competitions like posters, essay, slogan, quiz etc.

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