IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

HAZARD IDENTIFICATION MONITORING AND CONTROL IN BLASTING OPERATION

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ABSTRACT

Blasting in mines is a hazardous operation and comprises of extensive natural wellbeing anddanger to excavators because of residue, exhaust, ground vibration, air overpressure and fly shake. Blasting likewise harms the structure or property in the region of the mines or Blasting zone, and thefundamental driver for such harm are air overpressure and ground vibration. Blasting accidents in themining business will in general outcome in basic wounds or fatalities. Mischance reports and data gathered from the Mine Safety and Health Administration (MSHA) and other government organizations give supporting proof. As indicated by the information gathered, blasting related mishaps (in mining) were multiple times more serious than every other sort of mining mis chances. Blasting mishaps are not extraordinary to mining tasks - a similar circumstance exists in the development field. To conquer the impacts of Blasting Hazards, there are such a large number of tenets and safetask methods are encircled according to Metal life or us Mines Regulation 1961 and D.G.M.S. Brochures. The one of the critical factor in this is Blasting Zone. The Blasting Danger zone is 500 meters range of the Blasting territory. No individual ought to enter in the Blasting zone amid the blasting. In specific conditions it is extremely important to take a shooting task in where event of critical structures, plants or any in fra structure inside the Blasting zone. In such cases we have take unique shooting system to avoid fly rocks, ground vibration and furthermore significance of well being. To control the evil impact of ground vibration and air overpressure a legitimate hazard evaluation is important. In the wake of making the evaluation rules could be confined for observing and controlling.

Keywords : Mining tasks, Blasting Zone and shake breakers.

1. INTRODUCTON

Normally Blasting is done in mines to uncover minerals in vast scale. On the off chance that dirt or delicate shake alone exists, they are unearthed by utilizing excavators. On the off chance that powerless or weathered shake is to be exhumed and is in little amounts, it very well may be unearthed utilizing mechanical breakers like shake breakers, splitters and so on. On the off chance that hard shake exists in substantial amount, and it is to be exhumed, at that point boring and blasting is the best strategy that can be embraced on the grounds that boring and blasting is the quickest and temperate method for removal of hard shake. The circumstance gets confounded while blasting is to be done close to any structures. While blasting, it results in some unfriendly ecological issues, as a piece of the aggregate vitality of the explosives utilized in blasting is expended in breaking rocks while the rest is dispersed. Generally blasting is carried out in mines to excavate minerals in large scale. If hard rock exists in large quantity, and it is to be excavated, then drilling and blasting is the best method that can be adopted because drilling and blasting is the fastest and economical way of excavation of hard rock. The situation gets complicated when blasting is to be carried out near any structures. While blasting, it results in some adverse environmental issues, as a part of the total energy of the explosives used in blasting is consumed in breaking rocks while the rest is dissipated. The dissipated energy creates environmental problems in the form of ground vibration, air overpressure and fly rocks. Ground vibrations and air blasts are an integral part of rock blasting and are unavoidable. For that, accurate control must to be seriously considered to minimize blasting effect on people and environment. When a blast is detonated, some of the explosive energy not utilized in breaking rock travels through the ground and air media in all direction causing air blast and ground vibrations. The scattered vitality makes ecological issues as ground vibration, air overpressure and fly rocks. Ground vibrations and air impacts are a basic piece of shake blasting and are unavoidable. For that, exact control must to be truly considered to limit shooting impact on individuals and condition. At the point when an impact is exploded, a portion of the dangerous vitality not used in breaking rock goes through the ground and air media toward all path causing air impact and ground vibrations. Air impact and ground vibration from blasting is a bothersome reaction of the utilization of explosives for removal. The impacts of air impact and ground vibrations related with blasting have been contemplated widely. Specific consideration has concentrated on criteria to control the vibration and avoid harm to structures. With the end goal to control and shield the structures from pernicious impact of ground and air vibrations, directions have been defined in various nations. These controls fluctuate from nation to nation contingent upon the sort and the development material utilized. In order to more accurately identify the hazards and to investigate the impact of any risk in the field of blasting operations in mines, it is necessary to classify and rank the risk of the blasting operations in order to identify the most significant factors that cause risk during blasting operations. As a result, the main criteria for the risk of blasting operations in the ten main groups of human resources, execution factors, operational conditions, rock engineering, drilling operations, blasting operation design, explosive block, effects and results of blasting operations, production and extraction consideration, and natural hazards are based on study of the open pit mines Gol-e-Gohar Iron Ore, Bama Lead and Zinc Mine, Sarcheshmeh Copper Mine, and Isfahan Stone Mobarake Iron & Steel Co.; historical research in this context was also identified Each major criterion was subdivided according to the criteria that influence the main criterion. The main criteria of human resources, execution factors, operational conditions, and blasting operation design were divided into a number of sub-criteria: these were important in the process of studying and rating by experts. In this category of criteria, the comparison and consideration of the importance of sub-criteria is necessary.

2. OBJECTIVES

To land at an appropriate impact plan parameter for shake blasting.
To land at an appropriate muting system to control fly rocks.
To screen ground vibration and air overpressure close basic areas.
To get great discontinuity thinking about less ground vibration and Fly rocks.
To propose methods for control of air overpressure and ground vibration.
To prescribe safe greatest charge per postponement to keep vibration levels inside as far as possible according to Director General of Mines Safety (DGMS), GOI suggestions.
To arrive at a suitable blast design parameters for rock blasting.
To arrive at a suitable muffling procedures to control fly rocks.
To monitor ground vibration and air overpressure near critical locations.
To get good fragmentation considering less ground vibration and Fly rocks.
To suggest procedures for control of air overpressure and ground vibration.

3. LITERATURE REVIEW

KECOJEVIC AND RADOMSKY (2004) studied about loader and truck safety and found out the severity and number of accidents involving loader and trucks are higher when compared to other operations. They established fatal categories and causes of accidents and control strategies are discussed and evaluated to increase hazard awareness.

DZIUBINSKI *ET AL*. (2006) studied basic reasons for pipeline failure and its probable consequences taking individual and societal risk into consideration and proposed methodology of risk assessment for hazards associated with hazardous substance transport in long pipelines. Taking that methodology as example, subsequent stages of risk analysis were considered paying special attention to the applied techniques and calculation models. A specific feature of this methodology was a combination of qualitative and quantitative techniques which offer a possibility of a full risk assessment for long pipelines.

LAUL*ET AL.*(2006) identified hazards (chemical, electrical, physical, and industrial) and potential initiators that could lead to an accident. Hazard analysis is used to evaluate identified hazards. Hazard analysis is done by "what if check list", Hazard and Operability (HAZOP) analysis, Failure Mode and Effect Analysis (FMEA), Fault Tree Analysis (FTA), Event Tree Analysis (ETA) and provided methods together with theadvantages and disadvantages, for developing a safety document for chemical, non-nuclear facilities.

JEONG*ET AL.* (2007) made a qualitative analysis by Hazard and Operability Method (HAZOP) to identify the potential hazards and operability problems of decommissioning operations and concluded that the decommissioning of a nuclear research reactor must be accomplished according to its structural conditions and radiological characteristics and radiation exposure must be controlled to within the limitation of the regulation to perform the dismantling work under the ALARA principle safely.

FRANK *ET AL.* (2008) carried out a risk assessment using common risk management tools. In basic tools, they used diagram analysis and risk rating and filtering. In advanced tools they used fault tree analysis (FTA), Hazard and Operability Analysis (HAZOP), Hazard Analysis and Critical Control Points (HACCP), Failure Mode Effect Analysis (FMEA) and established a severity categorization table which divides severity of consequence into noticeable, important, serious, very serious and catastrophic.

4. PERMISSIBLE LEVELS AND REGULATIONS

4.1 GROUND VIBRATION LIMITS FOR STRUCTURES

Diverse nations embrace distinctive measures of safe points of confinement of vibration. In India, for mining impacts, the admissible ground vibration for various kinds of structures is indicated by Directorate General of Mines Safety (DGMS), Ministry of Labor, Government of India [Anon, 1997]. As the reaction of structures because of impacting does not change with reference of the reason for which impacting is completed, a similar standard might be connected for non-mining ventures too. This standard considers PPV and the recurrence of ground vibration for choosing the passable dimensions.
Table 4.1: Shows that permissible peak particle velocity (mm/s) as per DGMS (Tech)(S&T) Circular No. 7 dated 29/8/1997.

Fig : 1 Ground Vibration on Structures

Type of structure	Dominant excitation frequency, Hz		
	< 8 Hz	8 – 25 Hz	> 25 Hz
A. Buildings/ structures not belonging to the owner			
Domestic houses/ structures	5	10	15
(Kuchha, brick and cement)			
Industrial Buildings (RCC and framed structures)	10	20	25
Objects of historical importance and sensitive structures	2	5	10
B. Buildings belonging to owner with limited span of life			
Domestic houses/ structures (Kuchha brick and cement)	10	15	25
Industrial buildings (RCC & framed structures)	15	25	50

Fig 2 : Permissible Peak Particle Velocity (mm/s)

4.2 MINING AREA AND BLAST WORK

In the Mining area where a present situation occurred that the Mines area is encountered very Hard rock at the Top most Benches, in which without developing the Top most Benches, it is impossible to Work and progress the bottom benches. Hence it is necessary to remove the Top benches. But the hardness of the rock at Top benches is very high such that it cannot be removed by using Rippers and Dozers. Hence it is necessary to take the Drilling and Blasting works.The Adjacent areas of the Topmost Hard Benches are very sensitive and critical areas. Since Petrol/Diesel Bunk were present very close to the Blasting area. Also on the other side Parking lot and Processing plant were also located closely. To carry out the Drilling and Blasting work at this particular area it is necessary to withdraw all the infrastructure/plants such that around 500 meters radius from Blasting place should be free from all the buildings. Practically it is not possible. Since the Processing plant is the main production unit for the mines. To remove this top most benches without disturbing the other structures and plants, it is an important aspects to have controlled blasting techniques in which, the Top bench hard materials will be carried out drilling and blasting. But due to blasting no damage or harm will occur to the adjacent area for both men and properties. The most well-known technique for controlling ground vibration and air overpressure is by limiting the charge weight per delay. Postpone shooting licenses to partition add up to rush into littler charges, which are exploded in a foreordained succession at determined interims. Impacting immediately or deficient defer numbers expands ground vibrations because of increment in most extreme charge per delay. Furthermore, vibration can be essentially diminished by enhancing impact structure parameters. It is important to set up ideal opening distance across, gap profundity, trouble, gap dispersing, powder factor and commencement arrangement to control vibration and air overpressure. It is opined by scientists that the fumbling of impacts in nearness to structures fills two needs to be specific control of flyrock and air overpressure levels.

"A NARRIAN Mines" Located at Megalahalli town, at Chitradurga Taluk and District, Karnataka. This Mines is having the Production limit of 2.5 million Tons for each Annum. It comprises of a rent zone of 163.50 Ha. The separation of the Mine from Chitradurga town is around 35 km. The Mine began working from 28.10.1952. Mine is worked in two movements of 8 hours each by automated open-cast mining technique by an arrangement of seats. Penetrating and impacting for unearthing is totally dispensed with. A large portion of the metal/squander development is delicate and it very well may be exhumed without the utilization of penetrating/impacting. Wherever, mineral is hard and lateritic in nature, it is relaxed by tearing and napping. Water powered rippers and excavators are sent for advancing seats and for taking care of metal/squander material. Excavators and Rear Dump Trucks are utilized for stacking and pulling of waste material/metal. Mineral body is taken care of and stacked by excavators into RDT's of 30 tons limit and transported to smashing/screening plants for isolation of ROM into aligned metal and fines of various evaluations. In current circumstance, the Mines territory is experienced Hard shake at the Top most Benches, in which without building up the Top most Benches, it is difficult to Work and advancement the base seats. Henceforth it is important to expel the Top seats. In any case, the hardness of the stone at Top seats is high to such an extent that it can't be evacuated by utilizing Rippers and Dozers. Consequently it is important to take the Drilling and Blasting works. The Adjacent regions of the Topmost Hard Benches are extremely touchy and basic territories. Since Petrol/Diesel Bunk were available near the Blasting zone. Likewise on the opposite side Parking parcel and processing plant were additionally found intently. To complete the Drilling and Blasting work at this specific region it is important to pull back all the foundation/plants to such an extent that around 500 meters range from Blasting spot ought to be free from every one of the structures. Essentially it isn't conceivable. Since the Processing plant is the fundamental generation unit for the mines.

5. CONCLUSION

The first step for emergency preparedness and maintaining a safe workplace is defining and analysing hazards. Although all hazards should be addressed, resource limitations usually do not allow this to happen at one time. Hazard identification and risk assessment can be used to establish priorities so that the most dangerous situations are addressed first and those least likely to occur and least likely to cause major problems can be considered later. From the study carried out in the iron ore and coal mine and the risk rating which were made and analysed shows that the number of high risks in the coal mine were more than that of iron ore mine and same goes for the events in medium risk. The high risks which were present in the iron ore mine were due to the loose rock on the face which can be reduced by proper dressing and supervision and due to the blasting done by an unauthorised person on which administration should take action and the person with proper certificates and appropriate experience should be appointed. The high risk in the coal mine were due to the fly rock on blasting which can be reduced by the following the steps like planning of round of shots, holes correctly drilled, direction logged, weight of explosive suitable for good fragmentation and to ensure its safe use. The problem due to the operation of large number of transport vehicles which cause lots of noise, dust and may even affect people in an accident so the roads must be properly and evenly spread for safe and comfortable movement of machines and proper traffic signals and boards should be installed over certain distance. Improper use of personal protective equipment can be managed by appointing security specially to check if all are wearing personal protective equipment and if not the entry in the working are should be prohibited.

The problem of inundation can be solved by making embankments to prevent mine from flooding and if possibility of happening is high then layout of seam wise working should be developed and anticipate its impact on surface features and structures and if the impact and dangers are excessive re-plan to bring them to minimum possible level. From the distribution of the risk in different risk groups for both the mine and the present arrangement and working methods it can be said that the iron ore mine is comparatively safer than the coal mine and the arrangements for risks reduction that are to be made are more in coal mine than iron ore mine as it has various more problems like spontaneous heating and inundation which are not there in the iron ore mine but on the other hand in iron ore mine the does not take any action to suppress the dust generated after blasting and is allowed to disperse in atmosphere on its on which creates concentration of suspended solids in air and the dust is spread over large area creating problems to the people living near to the mine are.

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