



जन शोधीदारी से जन कल्याण

भारत सरकार/Government of India
श्रम एवं रोजगार मंत्रालय/Ministry of Labour & Employment
खान सुरक्षा महानिदेशालय/Directorate General of Mines Safety

No. DGMS(Tech) Circular No. 14 of 2020

Dhanbad dated : 24 /12/2020

To
The Owner, Agent and Manager
All Coal and Non-coal Mines

Subject: Precautions against premature blast of Site Mixed Emulsion (SME) / Site Mixed Slurry (SMS) explosive.

Recently, in a fatal accident, occurred in an opencast coal mine, four persons were fatally injured and three received serious injuries due to premature detonation of Site Mixed Emulsion (SME) explosive column during charging in large diameter hole, drilled in a boulder.

- (A) The detail inquiry conducted to find out the cause and circumstances attending the accident revealed the following:
- Large diameter (150mm) holes, 0.7-1.0m in depth, were drilled in some boulders, measuring about 1.5m X 2.0m X 2.0m – 2.0m X 3.0m X 3.0m at an angle varying from about 40⁰-45⁰ from horizontal for fragmenting.
 - The primer [cast booster (weighing 100 gms) and NONEL] could not go of its own at the bottom of holes, drilled in boulders.
 - The mouth/collar of hole in boulder, being charged with SME explosive, was situated at a height of about 1.5-1.7m from ground level. Seven work persons, who were charging the hole, had to hold the hose pipe, carrying SME, above their shoulder because of it's heavy weight. The process itself was very tedious; as such it was an unsafe practice.
 - The hazards associated with the handling and use of explosive including Site Mixed Emulsion (SME) explosive were not identified and their risk were not assessed and addressed in Safety Management Plan.
 - No Standard Operating Procedure (SOP) for handling and use of explosive including Site Mixed Emulsion (SME) explosive was framed.
 - Training on handling and use of explosive including Site Mixed Emulsion (SME) explosive, was not imparted to persons employed in the mine for the purpose.
- (B) Premature detonation of SME explosive column (non-cap sensitive explosive) was not possible without initiation of detonator of NONEL which was inserted into cast booster (altogether called primer). Thus sufficient shock, transmitted to primer, must have caused the explosive column (SME) to explode accidentally. One or combination of the following reasons must have created shock to NONEL to initiate the explosive column:

- (i) The primer was placed at the mouth/collar of hole (1.0m in depth and inclined at 40⁰-45⁰ from horizontal) drilled in boulder as it did not move inside the hole by its own weight (100gms) because of inclination of the hole. When SMS explosive was poured at a speed of about 2.5kgs/sec, explosive (SME) column alongwith primer collided at the back of hole at high speed. This impact might have created sufficient shock to the detonator and cast booster for initiation, thus exploding the whole explosive column.
- (ii) During the process of manufacturing the non-electric (NONEL) detonators, there have been several incidents of tube initiation, both in our country and overseas, occurring when the tube has broken under tension. This tendency to SNAP, SLAP and SHOOT has also been experienced in the field as well.

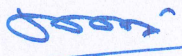
In an incident, a work person was attempting to remove a signal tube (NONEL) detonator from a hole when it got jammed. The worker pulled hard on the tubing, causing it to break. As the tube broke, the work persons noticed a spark at the hole collar and the detonator fired in the hole. Fortunately the bulk of the explosive had already been removed from the hole and the worker was not seriously injured.

In this particular case, there might have been undue tension in NONEL shock tube causing its breakage and created a SNAP, SLAP and SHOOT situation which ultimately caused unintended initiation of the shock tube resulting explosion of the explosive column.

- (iii) The Mercury Fluminate (highly sensitive) is sometime used instead of Lead Azide (less sensitive) to manufacture NONEL shock tube to cut cost (Mercury Fluminate is cheaper than that of Lead Azide). In such case, there might have been chance of accidental detonation due to small shock as well which might had been received due to the above mentioned reasons.
- (C) In order to avoid recurrence of such incidence in future, all concern are requested to take following precautions,
- (i) Fragmentation of boulders by blasting shall be avoided. Rock breaker or other similar device shall be used for breaking the boulder. If it is, at all necessary to carry out blasting in boulder, large diameter holes shall not be drilled in it for the purpose. Instead, in such cases small diameter (32mm) holes shall be drilled and blasted by small diameter explosive cartridges in small quantity.
 - (ii) Simultaneous blasting of charged holes in benched and that in boulders shall not be done.
 - (iii) Standard Operating Procedure (SOP) for handling and use of explosives including SME explosive shall be framed on the basis of assessed risk.
 - (iv) The amount of electrostatic charge generated and stored in conductive shoes & nylon socks, synthetic clothes etc. are unknown. If sufficient amount of electrostatic charge is stored, it may also cause premature initiation due to sudden release charge and causing spark. Thus the persons engaged in charging/stemming operation shall be refrain from wearing such conductive shoes/clothing/socks etc. during the said operations.
 - (v) The inclination of deep hole to be drilled (whenever necessary to do so) shall be such that the primer (detonator in NONEL inserted into cast booster) could be lowered at the bottom of hole easily with gravity.

- (vi) Drilling and charging operations shall not be done simultaneously in a place. Before charging operations, the area shall be fenced. No heavy earth moving machinery shall be deployed in the area till blasting is completed and area is declared safe by an official of the mine.
- (vii) The main composition of NONEL shock tube shall be verified from the manufacturer. If required, necessary testing shall be done from an authorized laboratory for the purpose. In no case the shock tube containing highly sensitive explosive (like Mercury Fulminate) shall be used for blasting.
- (viii) All initiating devices like shock tube detonators shall be used on 'first in first out' basis. Older the material, greater the risk in usage. All the shock tube detonators must be carefully examined for any physical damage and spillage of powders outside the metallic shells.
- (ix) In no case, the primer shall be placed in collar/mouth of deep hole and pushed it in the bottom of the hole alongwith SME/SMS explosive column. Rather the primer shall be gently lowered by gravity at the bottom of hole. When it is ensured that the primer reached at bottom of hole, the charging of SME/SMS shall be started.
- (x) Minimum number of persons shall be employed for charging and stemming of deep holes. The unsafe practice of holding the hose pipe, carrying SME/SMS explosive, above ground level by persons engaged in charging shall be eliminated.
- (xi) If the weather condition before and during blasting operation is such as to cause thundering and lightening, the blasting operations shall be immediately suspended and precautions suggested through DGMS Circular No. 10 of 2020 dated 23.06.2020 shall be followed.
- (xii) While conducting blasting in fire area/hot strata, the precautions mentioned in DGMS Circular (Tech) No. 2 of 1985 and No. 2 of 1990 shall be taken.
- (xiii) Drilling in misfire shots may be another reason for accidental detonation. In order to eliminate such incidence, the guidelines mentioned in DGMS Circular (Tech) No. 2 of 1983 and No. 10 of 2001 shall be followed in addition to the statute provided for the purpose.
- (xiv) All other guidelines on blasting operation, issued by DGMS from time to time in the form of circular, shall be followed.

I am sure that observance of the aforementioned precautions shall go a long way in preventing recurrence of such incidence in future.


24.12.2020

(प्रभात कुमार)

खान सुरक्षा महानिदेशक एवं

मुख्य खान निरीक्षक