

To
Owner, Agent & Manager of All Coal mines.

Sub: Support of roof and side in belowground coal mines.

Roof and side fall accidents still continue to be a major cause of fatality in belowground coal mines inspite of introduction of steel supports in such workings. An exercise was, therefore, undertaken to analyze in detail the accidents caused by fall of roof and side during the year 2000. Frequency distribution of all fatal accidents was carried out to identify the fatalities by major cause group. The analysis revealed that:

1. The roof fall and side fall accidents account for 35 percent of all the fatal accidents and 63 percent of all belowground fatal accidents in coalmines.
2. Only roof fall accidents account for 26 percent of all fatal accidents in coalmines and 48 percent of all belowground fatal accidents.
3. Side fall accidents account for 9.4 percent of all fatal accidents and 14.5 percent of all belowground fatal accidents.

The analysis further revealed that:

- i. 13 percent of roof fall accidents occurred during setting of supports and 3% during withdrawal of supports.
- ii. 63 percent of the roof fall accidents occurred within 10m of development and depillaring faces i.e. in freshly exposed roof area. 33 percent of such accidents occurred in depillaring district while 30 percent in development areas.
- iii. 26 percent of the side fall accidents occurred within 10m of the working faces.
- iv. All type of strata were involved in roof and side fall accidents. In the roof fall accidents, 40% of the fallen strata were coal. 17% were shale, 33% sand stone and remaining were combination of coal/shale or sand stone.
- v. The thickness of the fallen strata was up to 1m in 87 percent cases of roof fall accidents.
- vi. The thickness of fallen strata was up to 1m in 81 percent cases of the side fall accidents.
- vii. 70 percent of roof fall accidents occurred due to inadequacy of supports in the workings.
- viii. 73 percent of roof fall accidents and 81 percent of side fall accidents occurred where gallery width was more than 4m.
- ix. 84 percent of the roof falls and 64 percent of the side fall accidents occurred due to lapses on the part of management and supervision.
- x. 57 percent victims of roof fall accidents were loaders followed by 19 percent support Crewmembers.

It is obvious from the above analysis that most of the accidents were avoidable

The analysis of the accidents, observations of the officers during inspection of mines and interaction with support crew and subordinate supervisory officials revealed one or more of the

following deficiencies:

1. Systematic Support Rules were not being followed strictly.
2. Workmen were sometime going in-bye of the roof supports.
3. A temporary support was not provided in the freshly exposed area before engaging the Support crew for providing permanent support.
4. Inadequate or improper examinations of roof/side manifested into roof/side falls.
5. Proper dressing of roof and sides were not done prior to erection of support.
6. Support crew was not provided with proper tools *I* tackles
7. Safety support withdrawer was not provided and supports withdrawal was carried out by hammering on erected supports.
8. A system of side supports was not adopted where the coal had a tendency to spall.
9. Galleries were widened excessively without any purpose.
10. Support crew was not adequately trained. Sometimes loaders and other diverted untrained workers were engaged for bolting operation in the absence of regular support crewmembers.
11. Rope dowels were used in place of ribbed bars.
12. Grout was not able to provide the desired anchorage of 3 tonnes and 5 tonnes after ½ an hours and 2 hours of setting time respectively.
13. Nuts were not compatible with respective bolts resulting into slipping of nuts over threads.
14. Holes were not drilled in right direction and up to desired depth
15. Proper types of support materials as envisaged by tech. Circular No.3 of 1996 were not used.
16. Bolting was not done soon after the exposure of the roof resulting into bed separation
17. A system of anchorage testing and keeping record was not in vogue.
18. Instead of random anchorage testing, pre-decided bolts were subjected to anchorage testing.
19. A proper type of anchorage testing machine compatible with the bolts was not provided.
20. A system of monitoring of strata behaviour was not in vogue.

In the past, technical circular No.3 of 1993, Circular No.6 of 1994, Circular No.3 of 1995 and Circular No.3 of 1996 were issued in this connection. From the above observations, it appears that very little efforts have been made in this direction. It is, therefore, imperative that every mine adopts a sound, safe and standard supporting procedure, a brief guideline of which is given hereunder.

A. Scope: The procedure will detail selection of support crew members, classroom & on the job training on setting & withdrawal of supports, roof testing, equipping them with proper tools/ tackles, making them aware of their responsibilities and adoption of a system approach to tackle the situation, This will apply to all parts of belowground workings of every coalmine.

B. Objective- The objective is to reduce the likelihood of getting injury due to failure in identifying hazards related to fall of roof & side.

C. Selector of persons: Persons to be newly selected to form members of the support crew shall have a strong physique and good health to 'work on all man all job principle. However,

existing crewmembers having sufficient experience may continue if they are trained properly.

D. Training:

- Selected members of the support crew shall undergo initial basic training as per V.T. Rules and specific training modules developed for the support crew,
- They are to be appraised of different geological disturbances viz. faults, dykes, slips, fractured/sheared strata, ledges etc in coal mines, specially found in the mine they are to be deployed, detailing the type and method of supports requirements under different situations.
- They are to be appraised the significance of ringing/ drummy/ grumbling sound of roof & support when tapped with a stick and other phenomena like development of cracks in the roof and sides, bending or breaking of lids/props or buckling of props, water percolation from roof etc. for any sign of weighting on supports.
- They are to, be appraised of proper method of roof testing and dressing and taking personal protection in way of standing at safe place while testing the roof.
- They are to be appraised of systematic support rules applicable in the different parts of the mine.
- They are to be trained in proper use of tools/ tackles for supporting the roof, withdrawal of supports, anchorage testing etc.
- They are to be appraised the significance of providing temporary. support before engaging themselves for erecting permanent support.
- They are to be appraised the significance of supporting the roof as soon after the exposure of the roof as possible to prevent bed separation.
- They should be told the hazardous mechanism of roof and side fall. They are also to be explained about the method of work being practiced in the mine.
- Sufficient number of persons shall be given training to take care of absenteeism of the regular crewmember owing to various reasons.
- They should also be appraised of the phenomena of side spalling and method of providing side supports.
- They should also be appraised of recommendations of safety conferences on the subject.

E Procedure:

- i. In the beginning of the shift, the support man accompanied by the Mining Sirdar shall check and test the conventional supports in the development and depillaring area and shall assess the requirement of additional supports to be provided during the shift.
- ii. After every round of blasting, support of roof and sides shall be tested at all places within the zone of influence of blasting as decided by the manager.
- iii. Bolting of roof shall be done as soon as possible after exposure of the roof.
- iv. 9% of the bolts shall be subjected to anchorage testing for assessment of prescribed anchorage strength and 1 percent shall be subjected to destructive testing to assess the efficacy of support requirement and a record of such tests shall be maintained in a bound paged register kept for the purpose in the format as prescribed by D.G's Technical Circular No.3 of 1996.
- v. . Separate crew shall be provided for the haulage and the traveling roadways and old workings.
- vi Where the coal has a tendency to spell, the sides shall be kept supported systematically in addition to roof supports.

F. Equipping:

As per requirement, support crew shall be provided with hammer, adjustable wrenches, crowbar, suitable buntons, measuring tape, adze/ axe, pusher/stemming rod, etc. A sufficient supply of support materials shall be ensured. Safety support withdrawal machine, anchorage testing machine, tripods etc., shall be provided where required. Crewmembers shall also be given personal protective equipments.

G. Responsibility: A support crew is responsible for providing proper and adequate supports of roof and sides of the working places assigned to him. He is also responsible for checking and resetting the old conventional supports where required and also for safe withdrawal of support materials where required. It is needless to mention that he is also responsible for his own safety while setting, testing and withdrawing the supports.

Sirdar and overman are responsible to ensure that entire operations of roof/side examinations, erection/withdrawal of supports etc are carried out in a safe manner as prescribed.

Manager, Assistant Manager Under Manager are responsible for providing proper tools/ tackles and training to the crew members and also to ensure that entire operations are carried out in a safe manner.

H. Recommendations of the Ninth Conference on safety in mines- Recommendations of the Ninth conference on safety in mine on coal mine supports are also reproduced below for compliance:

- Suitable type of steel/metal supports should be introduced .in all the development districts in coalmines within two years.
- Wherever practicable, roof bolting as a method of support in coal mines should be used. Its performance should be monitored regularly. A few conventional timber props may be used as indicator props.
- Coal mining companies should take initiative to select/promote development of suitable type of drills & other accessories for use in various types of roof strata. A task force may be created for the purpose, which may oversee the introduction of steel supports.
- Development of a portable instrument, for detecting the hidden slips in the roof of coalmines should be taken up on priority .by R&D organizations.

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