

THE METALLIFEROUS MINES REGULATIONS -1961

MMR 4 & 5

Monthly and Annual Returns

Returns should be written in ink and signed legibly by the owner, agent or manager of the mine or a person holding a power of attorney from the owner. [Section 85-B of Mines (Amend.) Act, 1983]. Designation of the person who signs the returns should be clearly indicated. If any person signs in Hindi or other vernacular, its English transcription should also be given. Special care should be exercised to ensure that the forms are filled in correctly.

To prevent difficulties due to sheets coming apart, it is advised that:

1. each page of the return should carry name of the mine and a reference to the period to which the return relates; and
2. all sheets in each return should be properly bound together. ;

[Cir. 2/1948, 19/1958, Mines (Amend.) Act 1983]

Address for correspondence for examinations and for mines returns

At present as required under the existing Rules and Regulations, correspondence concerning the examinations conducted by the Board of Mining Examinations under Coal Mines Regulations, 1957 and the Metalliferous Mines Regulations, 1961, and the Annual and Monthly Returns to be submitted under the relevant Regulations are being addressed to the Chief Inspector of Mines (since designated as Director General of Mines Safety).

To cut down delay, it is required that in future annual, quarterly and monthly" returns' etc. may be addressed to :

The Director General of Mines Safety.

[Attention: The Deputy Director (Statistics),] Dhanbad,

and all correspondence concerning examinations may be addressed direct to :

The Chairman, Board of Mining Examinations.

[Attention: The Joint Director of Mines Safety (Exam.)]

Office of Director General of Mines Safety, Dhanbad.

(Cir. 41/1970)

MMR 8

Substitute appointments of assistant managers and surveyors

When services of Assistant Managers and Surveyors are transferred to another mine of the same management or terminated, substitutes are not being appointed, for a considerable time in some cases. Sometimes even notice of such termination of the services is not given for a long time in contravention of Reg. 8(2) of the Coal Mines Regulations 1957 which requires a notice to be given within 7 days of any appointment or termination of the services of such officials.

The requirements of law in this regard should be strictly complied with, and substitute appointments of Assistant Managers and surveyors should be made latest within two weeks of the permanent incumbent leaving the service of the mine.

(Cir. 34/1964)

Notice of appointment/termination of engineers

Notice under Reg. 8 of CMR 1957 and MMR 1961 in respect of Appointment/ Termination of an Engineer in Form I of the First Schedule should be accompanied by a supplementary form in the proforma given below:

**Supplementary form to accompany Notice in Form I in respect of
Appointment/termination of Engineer**

1. Mine particulars:

- (i) Name of Mine: Mineral worked:
(ii) Postal address of owner :
(iii) Name and address of owner:
(iv) Inspection Region to which the mine belongs:

2. Particulars of Engineer:

- (i) Name:
(ii) Father's name:
(iii) Date of birth: Age:
(iv) Permanent address:
(v) General qualifications:
(vi) Engineering qualifications:

Degree/Diploma	institution from which obtained	date of obtaining degree/diploma
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(vii) TECHNICAL EXPERIENCE: (a) In Mines

Name of Mine	Capacity	Period: From..... To.....
1.		
2.		
3.		

(b) In places other than mines:

Name of Establishment	Capacity	Period: From.....to.....
1.		
2.		
3.		
4.		

(viii) No. and date of approval certificate obtained. if any, from the Directorate-General of Mines Safety; (This does not apply to Degree/Diploma holders.)

3. Aggregate H.P. of machinery in use under the charge of the Engineer at the mine.

4. Date of Appointment/Termination.

Date..... Signature.....

Place..... Designation: Owner/Agent/Manager

(Cir. 8/1968)

Notice of appointment of engineer & notice of temporary authorisation in the absence of engineer

According to Reg. 8(2) of CMR 1957 and MMR 1961, the owner, agent or manager is required to send notice of appointment of engineer to the DGMS and to the JDMS. In a number of cases it is not made clear whether both the authorities have been sent the notice. The notice should also be sent to the JDMS concerned and the fact indicated in the notice sent to the DGMS.

Notice of temporary authorisation, in case of temporary absence of Engineer [Reg. 33(3) of CMR 1957 and 34(4) of MMR 1961] should be sent to Joint Director of Mines Safety concerned.

[Cir. 24/1972]

MMR9

Death by heart failure or other natural causes

Failure of heart may be caused in the natural way or as a result of any injury received while engaged in any operations connected with mining. In the former case the occurrence can not be treated as a mining accident. It will, however, be appreciated that the fact of death having been caused due to heart failure can only be established by means of a post-mortem examination of the dead body. In case it is felt that death has been caused by heart failure in any operation whatsoever, the post-mortem report of dead body should be submitted to DGMS as soon as possible. In case of non-compliance with these instructions, the occurrence may be treated as an accident coming within the purview of the Mines Act.

(Cir. 37/1956)

In case it is felt that the death of a person/persons at work in the mine has been caused by natural causes and not by any accident, the dead body should invariably be submitted for a post mortem examination and a copy of the post mortem report should be sent to DGMS. While sending information about an accident in or about a mine to various authorities, an intimation giving details of the occurrence and pointing out that it is not a mining accident should also be sent to the local police. The police authorities may then take necessary action for sending the dead body for a postmortem examination. This procedure should be strictly adhered to in case it is contended that death of a person has been caused by natural cause such as heart failure and not by a mining accident or other accident in or about a mine.

(Cir. 30/1960)

Necessity of post-mortem examination in all cases of sudden death

Medical Officers employed in mines too often attribute the cause of death to heart failure in case of sudden death in a mine without carefully assessing the evidence available to them. On postmortem examination, in many such cases, gross internal injury e.g. rupture of liver, fracture of cervical vertebrae etc. has been found. In one case, evidence of head injury was also found. Such mistake has occurred specially in cases showing no external injury. But it must be realized that serious internal injury may occur in the absence of any external injury. To avoid such confusion it is required that Medical Officers should withhold their opinion, unless the case is obvious, and advise postmortem examination in all cases of sudden death in a mine.

Intimation of accidents burn injuries due to electric flash / spark.

It has been observed that while handling electrical apparatus, work persons are getting burn injuries due to electric flash / spark which some time turn into serious and fatal accident.

The provisions of Regulation 9 of the Coal Mines Regulations, 1957; 9 of the Metalliferous Mines Regulations, 1961 and 7 of the Oil Mines Regulation 1984 require intimation of serious and fatal accidents due to electricity to the Electrical Inspector of Mines. Since intimation of accident due to electrical burn has not been included in the above said Regulations intimation of the same is not

sent to DGMS unless it is serious / fatal. However, it is felt that such accidents should also be enquired into to ascertain the cause of accidents for taking the remedial measures to prevent such type of accidents in future. It is therefore, requested that intimation of all accidents caused due to electric flash/ spark in the mines be sent to the Electrical Inspector of Mines within the time stipulated under above Regulations.

(Cir. Tech. 11/2004)

Jurisdiction of Electrical accidents in residential areas of all the Mines under the Central Government Undertaking.

In supersession of Circular No.29 of 1972 and 23 of 1973 and as per the Notification No.S.O.659 Dated 20.1.82 issued by the Central Electricity Authority the following Circular is issued for observance of all the mines under the Central Government Undertaking. For the general information of the managements of all mines and for removing doubts whether the residential areas, pertaining to a mine, if fed from a Power Station or sub-station situated in or around a mine and forming part thereof, come within the jurisdiction of Electrical Inspectors of Mines, Govt. of India, or they come within the jurisdiction of the Electrical Inspectors of the concerned Inspectorate of the Central Electricity Authority the following clarification is issued after duly consulting the Central Electricity Board, in the matter :

- (1) If any power station/sub-station/switch station which supply electricity mainly for the purpose of working a mine or a number of mines under the same management, also supplies electricity to the residential areas of the mine or mines referred to, the supply to the residential areas shall be given from a separate control gear and only that portion from such control gear to the residential areas, shall fall within the jurisdiction of the Electrical Inspector of the concerned Inspectorate of the Central Electricity Authority.
- (2) Whereas, if the supply of electricity at a mine obtained from a power station/sub-station/switch station which supplies electricity, besides the mine, to other places as well, only that portion from the switch gear or gears which are feeding the mines shall fall within the jurisdiction of the Electrical Inspector of Mines, Govt. of India.
- (3) In cases falling under clause (1) above, the power station/sub-station/switch station shall fall within the jurisdiction of the Electrical Inspector of Mines, Govt. of India whereas, in cases falling under clause (2) above, such stations shall fall within the jurisdiction of the Electrical Inspectors of the concerned Inspectorate of the Central Electricity Authority.

Above circular laid down that lighting installations including overhead lines for the purpose of non-mining operation such as quarters, etc. shall come within the purview of inspection of the Electrical Inspectorate of the Central Electricity Authority concerned. It is, however, being noticed that in spite of the aforesaid Circular notices of accident pertaining to lighting lines are still being forwarded to the Electrical Inspector of Mines (now Director of Mines Safety/Dy. Director of Mines Safety, Electrical). Therefore, in future such notices must be sent to the Electrical Inspector of the Inspectorate of the Central Electricity Authority concerned. A copy, however, may be sent to the Director of Mines Safety (Electrical) for information only.

(Cir.Tech. 8/2001)

MMR 34

Charge Handing Over: Reference Manual of Safety Directives

Attention is invited to Circular Nos. 41 of 1961 and 38 of 1962 issued by this Directorate on the subject of preparation of charge report at the time of change of manager. The object of such

charge report is that the incoming manager is kept fully abreast of the various aspects of safety of the mine he is taking over. The Circulars outlined the need for outgoing manager to point out to the incoming manager all important matters relating to the safety of the mine. Every incoming manager is then expected to prepare a comprehensive note on the status of safety in the mine after acquainting himself with all aspects of the work, etc.

In spite of the above directives, it appears that several important directives issued by this directorate are not duly transmitted to the new manager whenever there is a change. The frequent change in the positions of managers brought about in the coal mines in the wake of Nationalization and consequent large scale re-organization had aggravated the position. This has led to a situation where the new managers (and through them, the next in hierarchy of supervision) are sometimes ignorant of specific directives on safety and this has been a contributory factor in some accidents.

In order to obviate any such transmission loss due to change of personnel, it is felt that there should be a bound book kept at the mine wherein all safety directives for the mine are duly recorded. This book thus serves as a reference manual on the status of safety in the mine and it should be one important specific item to be handed over by the outgoing manager to the incoming manager.

The reference manual as suggested above could also incorporate salient features of the mine. In this Directorate, a History Sheet is maintained in respect of each mine on analogous lines and it may be advantageous for the different Areas to consult the proforma of such history sheet at the Regional Offices and advise their individual units suitably. In the preparation of such a manual, care ought to be taken to see that all safety instructions and directives in respect of a mine are duly incorporated and the same is kept up-to-date regularly, under the signature of the mine manager and produced before the officer of DGMS when he is inspecting the mine.

(Cir. Tech. 9/1976)

Information to be sent in the event of regular manager proceeding on leave

Non-observance with the prescribed procedure, when the regular manager goes on leave, results in avoidable correspondence to seek clarifications. There should be no deviation from the procedure laid down in the Regulations and all the relevant particulars (such as the name, qualifications and experience of the person authorized, the date of commencement and ending of the authorisation, the reason for authorisation) should be intimated at the first opportunity.

Sometimes an assistant manager of another mine of the same organisation is transferred to officiate as manager. This should normally be avoided unless there is no assistant manager at the mine concerned or the regular manager is proceeding on long leave (or unless required by DGMS). However, if an assistant manager of another mine is authorised, it is necessary to send along with the letter giving information about the regular manager proceeding on leave a notice in Form-I notifying transfer of the assistant manager. It is also necessary to indicate, in such a forwarding letter, arrangements made to fill up deficiency in supervision caused by transfer of the assistant manager. Of course, when an assistant manager of the same mine is authorised to act as manager, a notice in Form 1 is not necessary.

(Cir. 45/1964)

Manager's Permit

It is necessary for a person to obtain a Manager's Permit before he takes charge of a small mine. Failure to do so renders the person concerned, and the agent and owner employing him, liable to criminal proceedings. In this connection, it should also be clear that a Manager's Permit is granted for the management of a particular mine and for a specified period only; and is not a general authorisation to manage any small mine.

(Cir. 17/1956)

MMR 37

Size of Foreman's District

The size of a foreman's district will amongst other things, depend upon type of mine i.e., an opencast or underground mine; degree of mechanization; steepness of workings; nature of working whether development drives or stoping district etc.

Taking into consideration different factors, it has been decided that the size of a foreman's district may be determined as follows:

A Opencast Mines

(a) Manually worked or Semi-mechanised

A foreman's district shall comprise of two or more mate districts subject to a maximum of 4 such districts within a radius of 1 km in a hilly terrain or 2 Km. in flat country.

Provided that there shall be not more than 75 persons under the charge of one mate and the total length of working faces in one or different benches in vertical plane shall not exceed 300m in a mate's district when it is in a hilly terrain or 500m in flat country as the case may be.

(b) Fully Mechanised

A Foreman's district shall comprise of mechanised working in which not more than two power shovels are operating with ancillary equipment viz: dumpers, loaders and drills etc.

B. Underground Mines

Assuming that a foreman can look after a mine having working points 2000m apart horizontally and 100m apart vertically at the extreme points, with up to 100 men under his charge, the workload for a foreman may be determined from the following empirical formula-

$$\text{Workload} = \frac{DLW}{200,000} = 100 \text{ points for full workload for a Foreman.}$$

where, D = vertical distance in metres between extreme working levels,

L = horizontal walkable distance in metres between extreme working points,

W = no. of workmen underground placed under the charge of a Foreman.

Provided, however, that-

(i) a foreman shall not be asked to supervise work of more than 2 stoping districts;

(ii) at least one foreman shall be appointed per shift; and

(iii) a foreman shall supervise the work of not more than 2 mates.

The above criteria are given here for general guidance only. If any variation of the above-mentioned directions becomes necessary in any mine due to any practical difficulties, the advice of concerned Joint Director may be sought. At the same time, depending on local conditions, a Joint Director may stipulate additional number of foremen to be appointed in the interest of safety of workers, as a special case.

It is expected that no mine management shall retrench any foreman if he becomes surplus to the requirement of a mine in accordance with the criteria given above.

(Cir.34/1974)

MMR 38

Appointment of surveyors in opencast metalliferous mines

For the preparation of plans of opencast metalliferous mines the management need not appoint a full or part-time surveyor or and it will be enough if they get their plans brought up-to-date within twelve months by a qualified surveyor. Some associations of mine owners have engaged qualified surveyors for preparation of plans of mines belonging to the members of the associations. This arrangement has also been approved.

(Cir. 15/1972)

ISO

Internal Safety Organisation (ISO) is one of the most powerful tool in the hands of the mine operators and workers for enhancement and improvement of the status of safety in Indian mines. Fifth Conference on Safety in Mines held at New Delhi on the 26th & 27th December 1980 in its' recommendations framed guidelines for the formation of "Safety Policy" and "Internal Safety Organisation". Arising out of the recommendations of the Fifth Conference on Safety in Mines, many mining companies have since formulated their "Safety Policy" and created "Internal Safety Organisation" to translate the principle of self-regulation into practice. So far as the functioning of the ISOs are concerned, it has been observed that their functioning could not reach the desired heights of achievement as projected by the National Tri-partite forum. Under the present circumstances in the mining industry looking at introduction of new and sophisticated technology, mining in increasingly difficult geo-mining locale and evolution of a more conscious technosocial environment, it is now time to revitalize the institution of ISO and all efforts must be directed towards making this institution highly effective. The Internal Safety Organisation in a company/organisation should be made independent and directly responsible to the authority/person made responsible for ensuring safety in mines, i.e. . The Chairman/Chairman-cum-Managing Director or a Director on the Board of Directors of a mining company. A system of reporting contraventions of the provisions of law by officers in this cadre should be evolved. A complimentary system for the rectification of the violations by the operative persons in the mines should also be developed and enforced. The head of ISO should regularly interact with the persons responsible for production in the mine to review the standard of safety therein. A written record for all such meetings should be maintained for information as well as necessary actions at all levels.

(Cir. Genl.2/1997)

Measures to make I.S.O. effective

The role of the internal safety organisation (ISO) in promoting the cause, of safety does not need any more emphasis when viewed from the current safety scenario in mines. Though, the successive safety conferences in mines deliberated on certain principles of self regulation, it was the Fifth conference on safety in mines held in 1980 which clearly spelt –out the structure , role and functions of ISO in every mining company. The matter was also covered extensively in the recommendations of the Courts of Inquiry of Kessurgarh Colliery and Sudamdih Colliery, wherein the role of Internal Safety Organisation was made specific. These recommendations have been circulated to the Industry vide Cir. Tech.1979. The Sixth conference on safety in mines contemplated further on expansion of the role and functions of the ISO.

But, from its inception as one of the main recommendations of the Fifth Conference on Safety in Mines, the ISO's contribution to safety in mines has been unfortunately clouded. It is an accepted fact that more thrust is required in strengthening the role and functioning of this institution.

An analysis of the chronological sequence of the status of Internal Safety Organisation and its functioning in mines from inception, in light of the present safety scenario in mines, appears to convey the following as the major shortcomings.

1. The functioning of the ISO in mines is far from meeting the desired objectives.
2. Corporate-level Safety Policy formulated and effected in mines by the mining companies have not been successful in mitigating the incidence of mining accidents and disasters.
3. Failure to effectively monitor the status of implementation of policy directives by the mining companies.
4. Ineffective inspection of mines for assessment of safety status.
5. Failure to effectively propagate the theme of safety in mine across the entire cross section of the management.

Thus, there appears to be an urgent need for reviewing critically, the entire concept of ISO, with a view to streamlining the efforts and identifying the grey areas in the field of safety, for tackling the

challenges effectively. In this connection, attention is also drawn to Cir. Genl. 2/1997, which was explicit in the role of ISO.

The managements of all mining companies are advised to adopt the following measures as recommended in the 5th and 6th Conferences on Safety in Mine and also in the recommendations of the courts of inquiries of 'Kessurgarh' colliery and 'Sudamdih' colliery in reviving the institution of the ISO for justifying its role in improvement of safety standards in mines-

- (a) The ISO in every mining company, shall make an in-depth mine-wise, cause-wise analysis of all fatal/serious accidents,
- (b) The ISO shall monitor the impact of the 'Safety Campaigns' drawn up by Board of Directors based on the ISO's analysis of accidents and also submit a report to the Board of Directors at intervals not exceeding 3 months.
- (c) The ISO shall be made independent of the production line at all levels.
- (d) The chief of ISO shall be of a senior rank, next only to the Dir. (Tech.) /M.D./Chief executive of mining company.
- (e) The ISO shall be multidisciplinary team, with a field set-up which shall be above the mine level.
- (f) For ISO to be effective in its functioning, suitable policy shall be framed on the basis of the following guidelines:
 - (i) a proper safety policy shall be drawn up at corporate level of the company.
 - (ii) A suitable machinery shall be evolved for effective monitoring of the implementation status of policy directives.
 - (iii) There shall be a system of periodic mine inspections for assessment of safety status.
 - (iv) all mine accidents and dangerous occurrences shall be independently inquired into by the ISO.
 - (v) The ISO shall make independent assessment of the safety implications in all cases of opening of new mine/ district, use of new equipment, adoption of new method of work and all grievances on safety related matters.
 - (vi) All applications for obtaining statutory permission, shall be studied and vetted by the ISO before submission.
 - (vii) Findings of the ISO on safety matters shall be discussed in the safety committee at mines.
 - (viii) The ISO shall periodically assess the functioning of the institutions of workmen's inspectors and the safety committee in mines.
 - (ix) There shall be a system of auditing the safety standards for each mine at intervals of not more than a year,

Owners, agents and managers of all coal, metalliferous and oil mines are requested to take all possible steps for achieving the set objectives of the institution of the internal safety organization.

(Cir. Gen. 1/1998)

MMR 60

Use of polyster film for original mine plans

The original mine plans are required to be prepared on mounted paper and tracings on tracing cloth are prepared from the original plans for various statutory purposes.

However, non-availability of good quality drawing paper mounted On cloth, in the Indian market, through indigenous Sources, has been causing concern to the mining industry in general.

The problem was discussed with the Director, Survey of India, Calcutta, who opined that presently the best medium for preparation and maintenance of plans is polyster tracing film (which is now being, manufactured by some Indian firms), which has better dimensional stability than best of the mounted paper,

Use should, therefore, be made of polyster tracing film of 125 micro gauge for preparation of original mine plans and of lesser gauge for tracings of various statutory/other plans.

(Cir. Genl. 2/1980)

MMR 100

Danger in cleaning running belt conveyors: provision of guards and fences

A number of fatal accidents take place with belt conveyors in underground mines. On examination of causes of these accidents it is revealed that the accidents mainly took place for the following reasons :-

(1) non provision of suitable guards, fences at the drive head and tail end of belt conveyor.

[contravention of CMR. 184(2) & MMR. 174(2)]

(2) cleaning of belt and conveyor drums when the machinery was in motion.

[contravention of CMR. 184(3) & MMR. 174(3)]

Suitable steps should therefore be taken to prevent recurrence of such accidents.

It is further suggested that persons responsible for care, maintenance and cleaning of belt conveyors are exposed to short term refresher courses at the Vocational Training Centers.

(Cir. Tech. 12/1983)

Provision of wiper cum dust collector trolley at tail end drum of conveyor belt

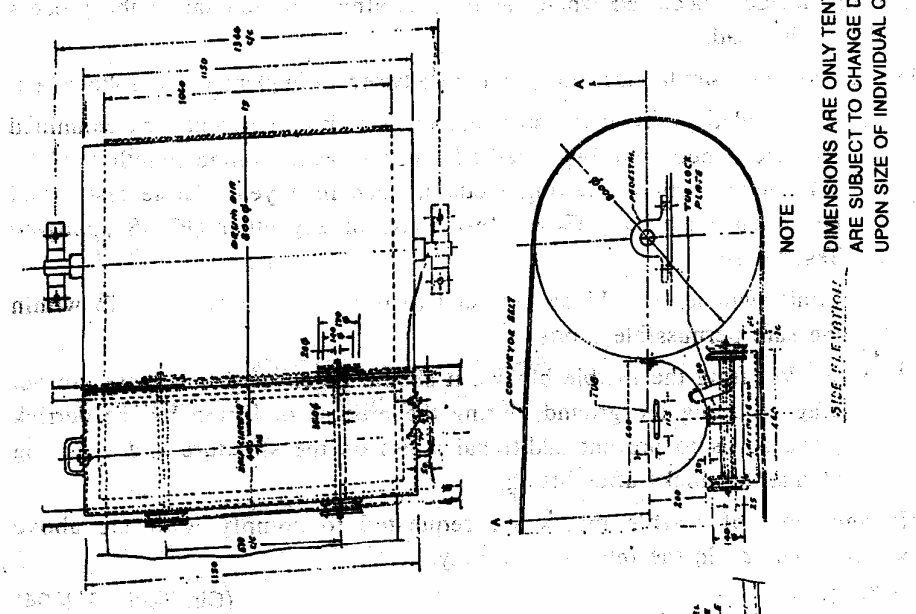
A number of fatal accidents take place with conveyor belt both below ground and aboveground at the tail end of the conveyor belt. Enquiry into these accidents has revealed that accidents take place primarily for the following reasons-

1. Non provision of suitable guards, fences at the drive head and tail end of belt conveyor, in contravention of provisions of Reg. 184(2)/Reg. 174(2) of the Coal Mines Regulations/Metalliferous Mines Regulations.

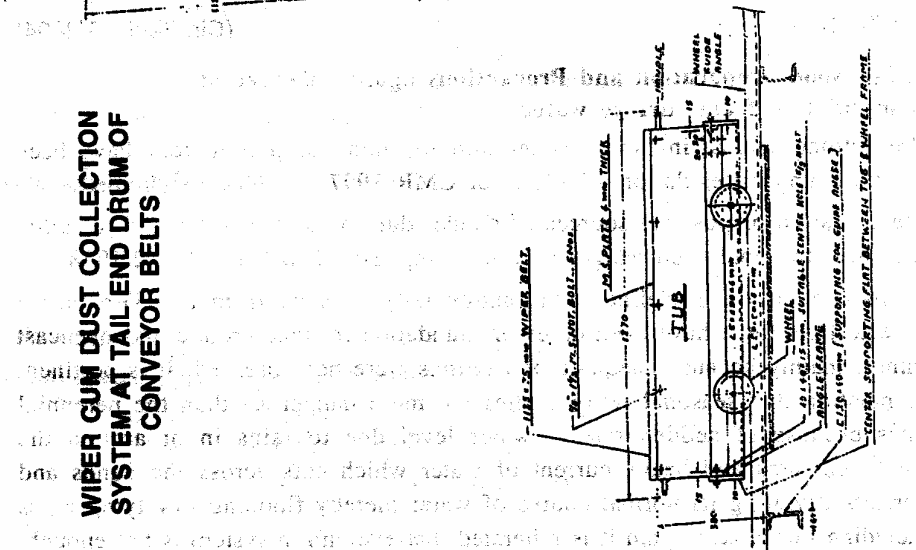
2. Cleaning of belt and conveyor drums while the machinery is in motion in contravention of the provisions of Reg. 184(3)/174(3) of the Coal Mines Regulations/Metalliferous Mines Regulations. Technical Circulars No. 11 of 1974 and No. 12 of 1983 were issued for taking suitable steps to prevent occurrence of such accidents. However, accidents at tail end of conveyors continue to occur which is a matter of concern. As the tail end drum is accident prone, limit switch needs to be provided with a tail end guard or the fencing. When the guard or fencing is removed, the limit switch trips the main switch and the belt cannot be started. However, in most of the mines, either the limit switch is not provided or is made defunct. A wiper cum dust collecting trolley at the tail end along with an additional limit switch has been provided at the tail end of belt conveyors in a few mines of M/s Western Coalfields Ltd. which is working quite satisfactorily.

The arrangement consists of a trolley prepared from half portion of 16" dia. MS pipe which acts as a container for the dust collection. This half portion of 16" dia. pipe is fitted with 4 wheels for sliding along a fixed frame, located in between the carrying and return belt adjacent to tail end drum as shown in the enclosed drawing. This dust collecting container is mounted on a frame having a pivoted arrangement, with the help of which this container can be tilted on either side for cleaning of dust collected inside. It has a wiper belt at the opposite side of tail end drum, which allows the dust to collect inside the container. There is a gate provided on one side of the system for taking out the trolley for cleaning purpose. This gate is attached with one limit switch, which activates for tripping off the control circuit of complete system, when the side gate is opened for cleaning the trolley and the belt can't be started till the gate is closed. Thus there is no chance of involving the cleaner, to work or clean at the tail end drum, as it is fully guarded and electrically inter-locked. The belt starts only when trolley is put to its position and then no manual operation is required to clean inside the tail end drum.

I trust the above recommendation shall be followed strictly in the interest of safety.
See the drawing ahead.

[illegible]

**WIPER GUM DUST COLLECTION
SYSTEM AT TAIL END DRUM OF
CONVEYOR BELTS**



A number of fires have been reported in conveyor belting being used in coal handling plants and open cast mines. Enquiry into such fires had revealed total devastation of the conveyor equipment and associated property of the mine. Such fire in belting in tunnel conveyors may cause serious risk of life to the persons present in the tunnels.

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- (i) Only fire resistant belting conforming to the standard recommended below shall be used while carrying crushed coal.
- (ii) Water hydrant line with tapping at every 40 meters with sufficient hose lengths shall be laid all along the belt conveyors working in the mine.
- (iii) All defective idlers bearings and defective lengths of belting shall be identified and replaced forthwith. Any other objects or parts of structure likely to cause friction or heating shall be removed.

Recommended Standard of fire Resistant Belting :

- (1) Fire Resistant properties of the cover – to conform ISO 340
- (2) Drum Friction Test – to conform IS 1891(Part - V) of 1993
- (3) Max. Surface Electrical Resistant – to conform IS 1891(Part V) of 1993
- (4) Cover Abrasion Loss (When tested as per DIN-53516) -175 mm³(Max.)

The above values are applicable for all types of Textile Conveyor Belting and Steel Cord Conveyor Belting to be used on surface in coal mines. Other mechanical properties like Adhesion PLY/PLY, Adhesion Cover/PLY, Cover thickness and cover tensile strength etc. may be fixed by the user industry in consultation of the belting manufacturer. No DGMS approval of the above belting is necessary.

However, any belting used in underground coal mine shall be of the type approved in writing by Director-General of Mines Safety as required under Regulation 181(3) of Coal Mines Regulations, 1957.

MMR 104

Accidents in railway sidings during shunting of wagons

A number of accidents have occurred in railway sidings during shunting of wagons when unwary persons employed in or about the siding were run over. The provisions of Reg- 96(3) of CMR 1957 and Reg. 104(3) of MMR 1961 on this subject read as follows-

"Before wagons are moved, persons likely to be endangered shall be warned by the competent person appointed under sub-regulation (2)", Enquiries into these accidents have revealed that though warning was given by the competent person in compliance of the above regulation, shunting of wagons was resorted to without ensuring that all persons likely to be endangered had actually moved to a place of safety. The spirit of the law implies that such precautions should be taken in all cases.

To illustrate the point, the following example may be of interest:

Loaded wagon was set in motion by two shuntmen after giving the usual warning, This wagon hit another stationary loaded wagon 8m further down, after which both the wagons together rolled down 18m and hit a third wagon on which two female wagons loaders were engaged in levelling loaded coal. One of the two female workers- was thrown over-board and was run over by the second wagon.

It may be appreciated that had the shuntmen ensured that the two female workers engaged on top of another wagon further down had got off the wagon, before starting manual pushing of the first wagon, thus complying with the provisions of Reg. 96(3) in spirit, this accident could have been avoided, In this particular case, however, the brake of the wagons was also not being controlled, Managements are therefore advised to take suitable steps to adopt adequate precautions in railway sidings during shunting of wagons so that shunting is not started unless all persons likely to be endangered have been moved to a safe place.

(Cir. Tech. 2/1984)

MMR 106

Conditions for use of heavy machinery /deep hole blasting

Provisions of Regulation 106(2)(b) of MMR 1961 lay down that if in any mine or part thereof it is proposed to work by a system of deep hole blasting and/or with the help of heavy machinery in such a manner as would not permit compliance with the requirements of sub-regulation (1) of the aforesaid regulation, the owner, agent or manager is required to give notice in writing to the DGMS and the JDMS. Such work can be commenced and carried out only in accordance with the conditions specified by the DGMS.

The conditions subject to which the use of heavy machinery and the adoption of deep hole technique is permitted by this office have been standardized. A copy of such conditions is given at Appendix for guidance . This may be useful while planning the operations.

(Cir. 36/1972)

APPENDIX

conditions for adopting a system of deep-hole blasting and/or working opencast mines with the help of heavy machinery for digging, excavation and removal of ore etc. under Reg.106(2) (b) of MMR 1961

I. GENERAL

I. (1) Except where otherwise provided for in this conditional permission, all provisions of the Metalliferous Mines Regulations, 1961 shall be strictly complied with.

(2) This conditional permission is subject to amendment or withdrawal at any time.

II. OPENCAST WORKING

Height and Width of Benches

2. (a) The height. of benches in overburden, ore body or other rock formation shall not be more than the digging height of the machine used for digging, excavation or removal.

Provided that in case of uniformly soft rocks, the Regional Inspector may permit the extension of the height upto 3m above the digging height of the machine.

(b) Width of any bench shall not be less than-

- (i) width of the widest machine plying on the bench plus 2m,
 - or (ii) if dumpers ply on the bench, 3 times the width of the dumper,
 - or (iii) the height of the bench, .
- , whichever is more.

Provided that the Chief Inspector may, subject to such conditions as he may specify therein, permit width of any bench to be less than its height.

(c) When persons are employed within 5m of the working face, adequate precautions shall be taken to ensure their safety by dressing the sides of the bench.

Roads for trucks and dumpers etc.

3.1 all roads for trucks , dumpers or other mobile machinery shall be maintained in good condition.

3.2 where practicable , all roads from the opencast workings shall be arranged to provide one way traffic. Where this is not practicable, no road shall be of a width less than three times the width of the largest vehicle plying on that road unless, definite turnouts and waiting points are designated.

3.3 All corners and bends in roads shall be made in such a way that the operators and drivers of vehicles have clear view for a distance of not less than 30m, along the road. Where it is not possible to ensure a visibility for a distance of 30m, there shall be provided two roads for the up and down traffic.

3.4 Except with the express permission of Chief Inspector in writing and subject to such conditions as he may specify therein, no road shall have a gradient steeper than 1 in 16 at any place. Provided that in case of Ramps over small stretches, a gradient upto 1 in 10 may be permitted.

3.5 Where any road exists above the level of the surrounding area, it shall be provided with strong parapet walls or embankments not less than 1 metre in height to prevent any vehicle from getting off the road.

Supervision

4. During every production shift, opencast workings shall be placed under the charge of an assistant manager and during maintenance shift the workings shall be placed under the charge of foreman, who shall be responsible to see that all the regulations and orders made there under are strictly complied with.

Maintenance of Machines

5.1 If the engineer, mechanical foreman or other competent person making an inspection notices any defect in any machinery, the said machinery shall not be used until the defect has been remedied.

5.2 Any defect in a machinery reported by its operator shall be promptly attended to.

5.3 Any machine found to be in an unsafe operating condition shall be tagged at the operator's position 'OUT OF SERVICE DO NOT USE' and its use shall be Prohibited until the unsafe condition has been corrected.

5.4 All repairs to a machine shall be done at a location which will provide a safe place for the persons engaged on repairs.

5.5 Except for testing, trial or adjustment which must necessarily be done while the machine is in motion, every machine shall be shut down and positive means taken to prevent its operation while any repair or manual lubrication is being done.

5.6 Power shall be disconnected when repairs are made to any electric machine.

5.7 Any machinery, equipment or part thereof which is suspended or held apart by use of slings, hoists, or jacks shall be substantially blocked or cribbed before men are permitted to work underneath or between such machinery, equipment or part thereof

Precautions while Drilling

6.1 The position of every deep hole to be drilled shall be distinctly marked by the mine foreman so as to be readily seen by the drillers.

6.2 no person shall be permitted remain within a radius of 20m or within 60m on the same bench where charging of holes with explosives is being carried out.

Transport of Explosives

7. where explosives are transported in bulk for deep hole blasting, the following precautions shall be taken-

(1) Transport of explosives from the magazine to the priming station or the site of blasting shall not be done except in original wooden or cardboard packing cases. The quantity of explosive transported at one time to the site of blasting shall not exceed the actual quantity required for use in one round of shots. Explosives shall be transported to the site of blasting not more than 90 minutes before the commencement of charging of the holes.

(2) (a) no mechanically propelled vehicle shall be used for the transport of explosives unless it is of a type approved in writing by the chief inspector. Provided that a jeep or land rover may be used for the transport of detonators from magazines to 'priming stations' subject to the following conditions-

- (i) not more than 200 detonators are transported in a vehicle at a time;
- (ii) the detonators are packed suitably in a wooden box;

- (iii) the wooden box containing detonators is placed inside an outer metal case of construction approved by the Chief Inspector;
- (iv) the outer metal case shall be suitably bolted to the floor of the vehicle or otherwise fixed in a wooden frame so that the container does not move about while the vehicle is in motion; and
- (v) no person shall ride on the rear portion of the vehicle.
- (b) Every vehicle used for transport of explosive shall be marked or placarded on both sides and ends with the word 'Explosives' in white letters not less than 15cm high on a red background.
- (c) Every mechanically propelled vehicle transporting explosives shall be provided with not less than two fire extinguishers (one of carbon tetrachloride type for petroleum fire and the other of carbon dioxide under pressure type for electrical fire) suitably placed for convenient use.
- (3) (a) The vehicle used for transport of explosives shall not be overloaded and in no case shall the explosive cases be piled higher than the sides of its body.
- (b) Explosives and detonators shall not be transported in the same Vehicle at the same time.
- (4) (a) No person other than the driver and his helper (not below 18 years of age) shall ride on a mechanically propelled vehicle used for transport of explosives.
- (b) A vehicle loaded with explosive shall not be left unattended.
- (c) Engine of a vehicle transporting explosives shall be stopped and the brakes set securely before it is unloaded or left standing.
- (d) A vehicle transporting explosives shall not be driven at a speed exceeding 25 kilometers per hour.
- (e) A vehicle loaded with explosives shall not be taken into garage or repair shop and shall not be parked in a congested place.
- (f) A vehicle transporting explosives shall not be refueled except in emergencies and then only when its engine is stopped and other precautions taken to prevent accidents.
- (g) No trailer shall be attached to a vehicle transporting explosives.
- (5) (a) Every vehicle used for the transport of explosives shall be carefully inspected once in every 24 hours by a competent person to ensure that:
 - (i) fire extinguishers are filled and in place,
 - (ii) the electric wiring is well-insulated and firmly secured,
 - (iii) the chassis, engine and body are clean and free from surplus oil and grease,
 - (iv) the fuel tank and feed lines are not leaking, and
 - (v) lights, brakes and steering mechanism are in good working order.
- (b) Report of every inspection made under sub-clause (a) shall be signed and dated by competent person making the inspection.
- (6) All operations connected with transport of explosives shall be conducted under the personal supervision of a foreman solely placed in charge of blasting operations at the mine.
- (7) The blaster shall personally search every person engaged in the transport and use of explosives and shall satisfy himself that no person so engaged has in his possession any cigarette, 'biri' or other smoking apparatus, or any match or any other apparatus of any kind capable of producing a light, flame or spark.

Precautions during Firing

8.1(a) shots shall not be fired except during hours of day-light or until adequate artificial light is provided. All holes charged on any one day shall be fired on the same day.

(b) As far as practicable, shotfiring shall be carried out either between shifts or during the rest interval, or at the end of work for the day.

8.2 During the approach and progress of an electric storm, the following precautions shall be taken:

- (a) no explosive, particularly detonators, shall be handled;
- (b) if charging operations have been commenced, the work shall be discontinued until the storm has passed;

- (c) if the blast is to be fired electrically, all exposed wires shall be coiled up and if possible placed in the mouth of the holes, or kept covered by something other than a metal plate;
- (d) all wires shall be removed from contact with the steel rails or a haulage track so as to prevent the charge being exploded prematurely by a local strike of the lightning.

Operation of machine

- 9.1 (a) No person other than the operator or his helper if any or the manager or any person so authorised in writing by the manager shall ride on a shovel or dragline.
- (b) No person shall be permitted to ride in the bucket of a shovel.
- (c) No shovel or dragline shall be operated in a position where any part of the machine, suspended loads or lines are brought closer than 3 meters to exposed high voltage lines, unless current has been cut off and the line de-energized. A notice of this requirement shall be posted at the operator's position.
- (d) Electrical cables, if any, shall be laid in such a manner that they are not endangered either by falling rocks or by a mobile equipment.
- 9.2 (a) Shovel bucket shall be pulled out of the bank as soon as it is full.
- (b) When not in operation, the bucket shall be pulled out of the bank as soon as it is full. .
- (c) When being operated in soft or unstable ground, every shovel (and dragline) shall be supported by heavy planks or poles so as to distribute the load of the machine over larger area and to prevent any- danger of the shovel (or dragline) over-turning.
- (d) When not in use, the shovel or dragline shall be moved to and stood on stable ground.
- 9.3 If more than one stripping machine is in use in any area, either on the same bench or on different benches, the machines shall be so spaced that there is no danger or accident from flying or falling objects etc. from one machine to the other.

Duties of Mechanics ,Fitters or Engineers

- 10.1 (a) At the- commencement of every shift, he shall personally inspect and test every machine and vehicle paying special attention to the following details:
 - (i) that the brakes and the warning devices are in working order;
 - (ii) if the vehicle or machine is required to work after day-light hours, that the lights are in working order.
- He shall not permit the vehicle or machine to be taken out for work nor shall he drive the vehicle unless he is satisfied that it is mechanically sound and in efficient working order.
- (b) The mechanic shall maintain a record of every inspection in a bound paged book kept for the purpose. Every entry in the book shall be signed and dated by the person making the inspection.

Operation of truck, dumpers and other vehicles

- 11.1 No person shall be permitted to ride on the running board of a truck or dumper.
- 11.2 (a) As far as possible loaded trucks or dumpers shall not be reversed on gradient.
- (b) Sufficient stop blocks shall be provided at every tipping point and these shall be used on every occasion the material is dumped from the truck, dumper, or other such vehicle.
- (c) Standard Traffic Rules shall be adopted and followed during movement of all trucks and dumpers. They shall be prominently displayed at the relevant places in the opencast working and truck/dumper roads.
- 11.3 When not in use, every truck or dumper shall be moved to be stood at proper parking place.
- 11.4 No person shall be permitted to work on the chassis of truck or dumper with the body in a raised position until the truck or dumper body has been securely blocked in position. The mechanical hoist mechanism alone shall not be depended upon to hold the body of the truck or dumper in raised position.
- 11.5 No unauthorized person shall be permitted to enter or remain in any dumping yard or turning point.

Duties of Machine operators

12.1 (a) The operator shall not operate the machine when persons are in such proximity as to be endangered.

(b) He shall not swing the bucket of shovel over passing haulage units, While the trucks/dumpers are being loaded, he shall swing over the body of the truck/dumper and not over the cab, unless the cab is protected by a substantially strong cover.

12.2 The operator shall not allow any unauthorised person to ride on the machine.

Duties of Truck / Dumper Operators

13.1 (a) He shall not drive too fast, shall avoid distractions, and shall drive defensively. He shall not attempt to overtake another vehicle unless he can see clearly far enough ahead to be sure that he can pass it safely. He shall also sound the audible warning signal before overtaking.

(b) When approaching a stripping equipment, the driver of the truck, dumper shall sound the audible warning signal and shall not attempt to pass the stripping equipment until he has received proper audible signal in reply.

(c) Before crossing a road or railway line, he shall reduce his speed, look in both directions along the road or line and shall proceed across the road or line only if it is safe to do so.

(d) The driver shall sound the audible warning signal while approaching 'blind' corner or any other point from where persons may walk in front unexpectedly.

(e) The driver shall not operate the truck or dumper in reverse unless he has a clear view of the area behind the vehicle or he has the assistance of a 'spotter' duly authorised in writing for the purpose by the manager. He shall give an audible warning signal before reversing a truck or dumper.

(f) the driver shall be sure of clearance before driving through tunnels, archways, plant structures etc.

13.2 The driver shall see that the vehicle is not overloaded and that the material is not loaded in a truck or dumper so as to project horizontally beyond the sides of its body and that any material projecting beyond the front or rear is indicated by a red flag during the day and by red light after day light hours.

13.3 The driver shall not allow any unauthorised persons to ride on the vehicle. He shall also not allow more than the authorised number of persons to ride on the vehicle.

(Cir. 36/1972 & Tech. 17/1977)

Precautions with heavy earth moving machinery

The following procedures and precautionary measures shall be adopted in use of heavy machineries:

(1) At least once in two weeks the brakes of the truck, dumper or any such other vehicle should be tested as indicated below:

(a) **Service brake test-** The brake shall be tested on a specified gradient and speed when the vehicle is fully loaded. The vehicle should stop within a specified distance when the brake is applied. The specified stopping distance shall be obtained from the manufacturer of the vehicle.

(b) **Parking brake test-** Parking brake should be capable to hold the vehicle when it is fully loaded and placed at the maximum gradient of roadway which is permitted for a period of at least ten minutes.

(c) A record of such tests shall be maintained in a bound paged book and shall be signed by the person carrying out the test. These records should be countersigned by the engineer and manager.

(2) Surprise inspection shall be carried out by the engineer/superior official at an interval not exceeding 15 days to ensure that examination schedule of machineries/equipment is followed.

(3) while inflating tyres, suitable protective cages shall be used. Tyres shall never be inflated by sitting either in the front or on top of the same.

(4) While the vehicle is being loaded/unloaded on gradient, it shall be secured stationary by parking brake and other means such as suitably designed stopper blocks placed below the tyres.

(5) Operation and maintenance of heavy machineries such as shovels, dumpers etc. shall be done strictly in accordance with the operation instructions. The operation instructions and maintenance schedule could be obtained from the manufacturers.

(6) Fire on surface heavy machinery is a serious hazard to life and property. Large size of these machineries magnifies the problem by increasing the potential for fires, obstructing operator's view of fire hazards and restricting their egress from the machinery. With increasing size of machinery, portable extinguishers do not provide adequate protection.

To avoid these problems, automatic fire protection systems shall be provided and maintained in working order for surface heavy machinery such as coal haulers, mine haulage vehicles, ash haulers, dozers, front end loaders, draglines, bucket wheel excavators, blast hole drills, hydraulic and electric shovels etc. It is also necessary that the recommended procedure for testing of such fire protection systems at a given schedule by the manufacturer is Adopted. Automatic fire system consist of one or more containers of fire suppressant (usually a dry chemical) connected by a fixed plumbing network to nozzles directed at specific pre-determined fire hazard areas of the machinery.

Optical, thermal or any other suitable type of sensing device is suitably located to sense the fire and actuate suppressant to come out through the nozzles already fixed to deal with the fires. An overriding manual system along with fire alarm could also be additionally provided for better effectiveness of the system.

The above procedure and precautionary measures shall also form a part of circular 36 of 1972 i.e. conditions for working opencast mines with the help of heavy machinery under Reg. 106(2) (b) of MMR 1961.

(Cir. Tech. 3/1981)

Precautions against inadvertent movement of HEMM during repair

Recently in one of the mines, while a mechanic-cum-driver was adjusting the engine clutch of a stopped Leyland Commet tipper lorry, the engine started itself due to inadvertent short circuit at solenoid switch and the lorry moved in the reverse direction. He was instantly run over by the front right wheel of the lorry and killed on the Spot.

In this connection attention is once gain invited to Cir. 36/1972 and Tech. 3/1981 which cover requirements for proper care, maintenance and examination of heavy earth moving vehicles. The following procedure should be adopted to avoid recurrence of similar accidents:

1. Parking brake must be used while parking vehicles. The gear shift lever should be engaged in reverse while vehicles are on down gradient or on level roads, and in low gear positions while on up-gradients.
2. In existing vehicles, solenoid terminals and connection cable suitably insulated to avoid inadvertent short circuiting of solenoid terminals.

(Cir. Tech. 11/1983)

Precautions in tyre inflation

Recently in one of the mines there was a fatal accident in which a fitter helper died. While opening a shuttle car wheel underground, the tyre burst throwing out the locking ring with tremendous force causing the fatality. It was found that the lock ring was indigenously developed and its sectional profile was not matching with the wheel rim groove.

To avoid such accidents in under ground mine or in open cast mines where heavy earth moving machineries are used, only suitable type and matching locking ring of correct size shall be used. Periodically the locking ring of every tyre shall be examined for its suitability, and record of such

examination shall be maintained. While fitting a new locking ring, it should be ensured that it fits correctly in the rim groove.

(Cir. Tech. 9/1979)

Dump workings

Extraction of mineral by reclamation from dump working is common in many mines. Such extraction however is fraught with danger of collapse of loose debris if the reclamation is not done with due care.

The position is analogous to working in opencast benches with loose overburden where provisions of Reg. 98 of CMR 1957/Reg. 106 of MMR 1961 are attracted. Failure to do so had resulted in a few accidents- some of them resulting in loss of life. In a recent accident in an iron-ore mine, while persons were engaged in loading fines dumped earlier, a large mass of fines (approximately 120m³ in volume) slid down and buried one worker. His body was recovered 80 minutes later. Managements are advised to ensure that in ore dumps precautions are taken similar to those specified for opencast mining in loose soil to avoid danger to work persons.

(Cir. Tech. 13/1977)

Model code of precautions for truck transport in open cast mines

The most common mode of transport of ore and materials in opencast mines whether big or small is ordinary truck and its use is on the increase. So are unfortunately the accidents due to the use of truck.

An analysis of such accidents shows that majority of them occurred due to failure of brakes or while reversing the truck, and to persons who were riding trucks unauthorisedly or otherwise. All mines in which trucks are deployed in mining operations ought to take adequate precautionary measures against occurrence of such accidents within their leasehold or area of control.

Accordingly, a model code of precautions to be taken for truck transport in opencast mines is given below. The same shall be enforced either in the form proposed or with modifications considered necessary to suit the local conditions and requirements after getting concurrence of the concerned Joint director of mines safety.

Model Code of Precautions for truck Transport in Opencast Mine

1.0 Roads for trucks etc.

1.1 all roads for trucks, or other mobile machinery, referred to hereinafter as vehicle, shall be maintained in good condition.

1.2 Where practicable, all roads in and from the opencast workings shall be arranged to provide one-way traffic. Where this is not practicable, no road shall be of a width less than three times the width of the largest vehicle plying on that road unless definite turnouts and waiting points are designated.

1.3 All corners and bends in roads shall be made in such a way that the operators and drivers of vehicles have a clear view for a distance of not less than 30m, along the road. Wherever it is not possible to ensure a visibility for a distance of 30m, there shall be provided two roads for the up and down traffic.

1.4 Ordinarily, no road shall have a gradient steeper than 1 in 16 at any place. Provided that in case of ramps over small stretches a gradient up to 1 in 10 may be permitted. ...

1.5 Where any road exists above the level of the surrounding area, it shall be provided with strong parapet walls or embankments not less than 1 meter in height to prevent any vehicle from getting off the road.

1.6 Road signs shall be provided at every turning point for the guidance of drivers specially at night time.

1.7 At every curve, parapet walls or vertical posts with 'Zebra' lines shall be provided , to help the drivers to keep the vehicle on the track specially at night time.

2.0 Maintenance of vehicles

2.1 (a) The vehicle shall be maintained in good repair, and examined thoroughly once at least in every week by the engineer or other competent person appointed by the manager in writing for the purpose.

(b) The competent person shall maintain a record of every such inspection in a bound paged book kept for the purpose. Every entry in the book shall be signed and dated by the person making the inspection.

2.2 If the engineer or other competent person making an inspection notices any defect in the vehicle, the said vehicle shall not be used until the defect has been remedied.

2.3 Any defect in a vehicle reported by its driver shall be promptly attended to.

2.4 Any vehicle found to be in an unsafe operating condition shall be tagged at the driver's position OUT OF SERVICE DO NOT USE and its use shall be prohibited until unsafe condition has been corrected.

2.5 Every vehicle shall be regularly serviced and overhauled as per the recommendation of the manufacturer. A written record of each servicing and over-hauling shall be maintained.

2.6 Except for testing, trials or adjustment which must necessarily be done while the vehicle is in motion, every vehicle shall be shut down and positive means taken to prevent its operation while any repair or manual lubrication is being done.

2.7 Any vehicle, equipment or part thereof which is suspended or held apart by use of slings, hoists or jacks shall be substantially blocked or cribbed before men are permitted to work underneath or between such vehicle, equipment or part thereof.

3.0 Daily examination of vehicles

3.1 (a) At the commencement of every shift. a mechanic or other competent person specially appointed in writing by the manager for the purpose shall personally inspect and test every vehicle paying special attention. to the following details-

(i) that the brakes and the horn or other warning devices are in working order;

(ii) if the vehicle is required to work after day-light hours (i.e. half-an-hour after sunset and half-an-hour before sunrise) that the lights are in working order,

The competent person shall not permit the vehicle to be taken out for work nor shall he drive the vehicle unless he is satisfied that it is mechanically sound and in efficient working order.

(b) The competent person shall maintain a record of every inspection in a bound paged book kept for the purpose. Every entry in the book shall be signed and dated by the person making the inspection.

4.0 Operation of vehicle

4.1 No person shall be permitted to ride on the running board of a vehicle.

4.2 As far as possible. no loaders/labourers. shall be allowed to ride trucks, whether loaded or empty. Where this cannot be avoided due to practical considerations, the body of the truck shall be re-designed to provide separate compartment at the back of the truck in which workers may take a seat.

4.3 (a) As far as possible loaded vehicles shall not be reversed on gradient.

(b) Sufficient stop-blocks shall be provided at every tipping point and these shall be used on every occasion when the material is dumped from the vehicle.

(c) Standard Traffic Rules shall be adopted and followed during movement of all vehicles. They shall be prominently displayed at the relevant places in the opencast workings and roads.

4.4 When not in use, every vehicle shall be moved to and stood on proper parking place.

4.5 No person shall be permitted to work on the chassis of a vehicle with the body in a raised position until after the body has been securely blocked in position. The mechanical hoist mechanism, if any alone shall not be depended upon to hold the body of the vehicle in raised position.

4.6 No unauthorised person shall be permitted to enter or remain in any dumping yard I, or turning point.

5.0 Duties of drivers

5.1 Before commencing work in a shift, the driver shall generally examine the vehicle for its roadworthiness, and in particular check the tyre air pressure, brakes, horn and lights. If he finds any defect which will make the driving unsafe, he shall report the matter to the competent person and get the defect remedied before operating the vehicle.

5.2 driver shall not drive too fast, shall avoid distractions, and shall drive defensively. He shall not attempt to overtake another vehicle unless he can see clearly far enough ahead to be sure that he can pass it safely. He shall also sound the audible warning signal before overtaking.

5.3 Before crossing a road or railway line, the driver shall reduce his speed, look in both directions along the road or line and shall proceed across the road or line only if it is safe to do so.

5.4 driver shall sound the audible warning signal while approaching 'blind' corners or any other points from where persons may walk in front unexpectedly.

5.5 driver shall not operate the vehicle in reverse unless he has a clear view of the area behind the vehicle or he has the assistance of a 'spotter' duly authorised in writing for the purpose by the manager. He shall give an audible warning signal before reversing the vehicle.

5.6 the driver shall make sure of clearances before driving through tunnels, archways, structures etc.

5.7 the driver shall not operate a vehicle in fog or mist without taking adequate precautions, as may be specified by the manager.

5.8 the driver shall not operate the vehicle while being in a state of drunkenness, and without due care and attention having regard to all circumstances including the nature, condition and use of the road or other place over which the vehicle is being driven and the visibility at the time.

5.9 the driver shall see that the vehicle is not overloaded and that the material is not loaded in a truck, so as to project horizontally beyond the sides of its body and that any material projecting beyond the front or rear is indicated by a red flag during the day and red light after day-light hours.

5.10 the driver shall not allow any unauthorised person to ride on the vehicle. He shall also not allow more than the authorised number of persons to ride on the vehicle.

6.0 Duties of Manager

It shall be the duty of the manager-

(a) to ensure compliance with the aforesaid precautions;

(b) to determine and specify in respect of every vehicle the maximum load to be hauled, and maximum speed of the vehicle, and cause notices specifying the same to be posted along the road at appropriate places;

(c) to cause warning, notices (drawing attention to any necessary precautions) to be posted along the truck or haulage roads at appropriate places, like level crossing, curves and turning points etc.

(d) to designate the persons authorised to ride on trucks;

(e) to give every truck driver directions in writing with respect to loads, speed, persons unauthorised to ride on trucks. and precautions necessary for safe running;

(f) to countersign entries in books and records to be maintained in pursuance of these precautions;

(g) to take such other precautionary measures as may be necessary to ensure safe operation and maintenance of vehicles and for the safety of workpersons.

7.0 General

These precautions may be amended, modified or relaxed at any time by or in concurrence with the Joint Director of Mines Safety.

(Cir.11 /1973)

Model code of precautions for dumpers and other vehicles

In many mines dumpers, coal haulers, and trucks etc. are used for transportation of coal, minerals and other materials within the mine leasehold areas ;

Vide Cir. 11 of 1973 'a Model Code of Precautions for Truck Transport in Opencast Mines' had been suggested. It is hereby clarified that the suggestion of the above-mentioned Circular will be applicable to all vehicles used for transport of minerals or materials plying on surface within the mine leasehold area of opencast mines as well as of mines having workings belowground.

Specific attention is also invited to Cir. Tech. 7 of 1977, regarding precautions while reversing the vehicles.

(Cir. Tech. 4/1979)

Precautions while reversing vehicles

Several accidents have occurred in mines while reversing vehicles. The Code of Precautions for Truck Transport, (Circular 11 of 1973), clause 5.5 prescribes that where the view is not clear, the driver should take assistance of a spotter for operating the vehicle in reverse direction. He is also required to give an audible warning signal before reversing.

A separate horn with a sound different than normal horn of the vehicle should be provided for this purpose. The driver should continue blowing this horn during the process of, reversing the vehicle. Such horn should be standardised in a mine so that whenever a horn having a particular sound is given, it would become evident that vehicle is being reversed. In some countries manufacturers have provided such horns which operate automatically when the vehicle is reversed. Possibility of incorporating such arrangement should be explored.

In addition to a separate horn, flasher lamp at the rear end of the vehicle, in series with the dial light on the control panel, should be provided.

(Cir. Tech. 7/1977)

Precautions while reversing vehicles

Accidents due to transportation machinery in opencast mines continue to remain high and several such accidents have occurred while reversing vehicles.

The Code of Precautions for Truck Transport in Opencast Mines attached to Cir. 11/1973, requires audible warning signals before reversing. Cir. 7/1997 again drew attention of the industry to this hazard, requesting that a separate horn with a sound different from normal horn of the vehicle should be provided for the purpose. The driver, should continue blowing this horn during reversing, and the horn should be standardised in a mine so that whenever a horn having a particular sound is given, it would become evident that a vehicle is being reversed. Possibility of incorporating horns which operate automatically when the vehicle is reversed should also be explored.

In some of our mines such audio visual warnings have been provided, it is observed that sometimes the level of Sound of horn is so low so as to become ineffective and in other cases it is so high that it may even exceed the permissible limits of noise, posing another hazard. High sound level, beside causing hearing impairment and distraction, can even drown sound warning emitted from nearby sources posing additional hazard. Needless to say, the sound generated by the alarm should be such so as not to be shrouded by the sound of the vehicle sources but at the same time should not be high enough to cause impairment and become a source of another hazard.

It is recommended that an audiovisual backup alarm system which adjusts itself to the surrounding noise level maintaining minimum 5 dB (A) above the noise level may be used in trucks and

dumpers. Such alarm systems have been developed in other countries, .e.g. 'ECCO' of USA and marketed in India.

These or similar product may be tried.

(Cir. Tech. 12/1999)

Accidents due to dumpers , trucks and tractors etc. in opencast mines

The Sixth Conference on Safety in Mines made the following recommendations for prevention of accidents due to dumpers ,trucks and tractors etc. used for transport of minerals in opencast mines-

- (i) Adequate care should be exercised in selection and training of operators/drivers of dumpers and trucks/any other heavy earth moving machinery.
- (ii) Adequate number of dumper operators and drivers of trucks and heavy earth moving machinery and also pitmen and dumpmen should be appointed keeping in view factors like absenteeism and leave etc. Work on overtime should be abolished.
- (iii) Effective steps should be taken to prevent riding on dumpers and trucks by unauthorised persons. Adequate arrangements should be made for transport of machinery maintenance staff.
- (iv) Within a period of two years, all dumpers, trucks and heavy earth moving machinery operating within mine premises should be equipped with audio-visual alarms to facilitate safe reversal.
- (v) Transport and loading operations, including those done by contractors, should be supervised by competent persons. Where contractors are appointed for transport of minerals, examination of vehicles should be done by mine managements.

Action should be taken for complying with the above recommendations.

(Cir. Tech. 2/1986)

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Measures to reduce accidents in opencast mines (as recommended by Seventh conference on Safety in Mines)

Recent years have witnessed a major upsurge of interest and activity on opencast mines in our country. Unfortunately this upsurge has been associated with increased number of accidents in opencast mines. Analysis of fatal accidents in opencast mines during the years 1981 to 1987 reveals (see Appendix 'A') that majority of the accidents are caused by dumpers driven negligently/unauthorisedly on haul roads and associated roads. The following operations emerge as having high accident potential- .

- (i) movement of vehicles,
- (ii) tipping on dump sites,
- (iii) attending to repair of heavy equipment like dragline, dredgers etc.

An approach paper on the subject of 'Safety in Opencast Mining' was considered at the Seventh Conference on Safety in Mines. The delegates deliberated upon this subject and came to the conclusion that the hazards connected with the above mentioned operations could be tackled by :

- (i) having detailed 'traffic rules' governing the movement of all types of vehicles (heavy as well as light) whether belonging to the management or contractors or suppliers etc. operating within mine premises (see, Appendix 'C');
- (ii) giving greater emphasis to training and examination of operation of vehicles;
- (iii) having haul roads of prescribed specifications;
- (iv) improving visibility from operator's cabin and by making the operator's cabin such as to provide protection to the operator against hazards from heat, humidity, dust, noise etc.;
- (v) enforcing detailed 'code of practice' for tipping on stock piles or dumping of overburden and

(vi) complying with rules framed for preventive maintenance and safe operations during repair/erection of heavy equipment.

The seventh conference on safety in mines also made a number of recommendations so as to improve status of safety in opencast mines. These are given In Appendix 'B' below.

Implementation of these measures would bring down accidents in opencast mines. Managements are advised to act accordingly.

(Cir. Tech. 1/1989)

Appendix A

Fatal Accidents in opencast mines (1981 to 1987)

I. Accidents caused by different machines		%
(a) dumper/truck		70.4*
(b) payloader		6.2
(c) tractor		9.0
(d) dozer		5.2
(e) shovel/excavator		2.7
(f) drill/crane/scrapper		6.5
II. Accidents due to different causes		%
(a) negligent driving and unauthorised driving		42.0*
(b) unauthorised travelling on foot-board. body and cabin		21.4
(c) run-over while crossing haulroad or in cramped space		10.8
(d) reversal without spotter and non-provision of Audio-visual alarm		10.4
(e) others		15.4
III. Accidents at different sites		%
(a) haulroad and associated roads		58.6
(b) quarry operation area and its vicinity		19.6
(c) workshop/repair shop		9.0
(d) stock-yard and siding		6.2
(e) waste-dump		2.4
(f) others		4.2

Appendix B

Recommendations of Seventh conference on Safety in Mines on 'Safety in Opencast mining'

2.0 safety in opencast mining- 2.1 (a) each company should frame suitable 'code of Traffic Rules' for regulating the movement of Heavy Earth Moving machinery (commensurate with the capacity/size, type of machines used in the mechanised opencast mine) for enforcement in each mine. The Code of Traffic Rules should be approved by Tripartite Committee.

(b) The Code of Traffic Rules should be deliberated, framed and approved within a period of 6 months, and should be enforced in each mine within a period of 12 months.

2.2 (a) each company operating mechanised mines should frame suitable 'Code of Practice' for prevention of injuries to persons engaged in tipping on stockpiles, dumping of overburden at dump yards, at loading points etc. Such 'Code of Practice' should be approved by Tripartite committee.

(b) The 'Code of Practice' should be deliberated, framed and approved within period of 6 months. The Code should be enforced in each mine within a period of 12 months.

2.3 The design and maintenance of haul roads in mechanised opencast mines should be laid down by each company in respect of each mechanised opencast mine. If required, the company may consult/interact with DGMS in this regard.

2.4 (a) Each company should ensure that for every mine a scheme is drawn and implemented for proper maintenance, repair, overhaul and erection of Heavy earth moving machinery. This scheme should cover places such as repair sheds and workshops. Necessary help, if required, should be obtained from the manufacturers of HEMM.

(b) Adequate attention should be given towards proper layout of repair sheds and workshops so as to ensure due protection to work persons deployed at these places from the movement of heavy earth moving machinery therein.

2.5 The operator's cabin of heavy earth moving machinery should be well designed and substantially built so as to ensure adequate protection to operator against heat, dust, noise etc. and at the same time provide adequate safety to the operator in the event of overturning of heavy earth moving machinery. A seat belt for safety of the operator should also be provided.

2.6 (a) Operator/driver of each HEMM should be selected from amongst persons possessing requisite qualifications. The selection process should comprise of a test of check driving/operating skill, aptitude, health and oral examination of the candidate by a competent selection committee.

(b) All operators of HEMM should undergo regular checks to test their driving/ operating skill, knowledge and health once every five years.

(c) Suitable training institute/training centre should be opened in each company to provide comprehensive training so that only duly qualified and trained operators are always available commensurate with the present and future needs of the mechanised mines.

2.7 A separate format for writing statutory reports by shot-firers/blasters mining sirdars/mates and overmen/foremen employed at opencast mines should be prepared and circulated early.

2.8 A format for writing report of inspection of dragline wire ropes should be introduced early.

2.9 A code of practice shall be drawn up for dealing with fire at different locations in open cast mines including HEMM. Arrangements for fighting fire should be provided on all heavy earth moving machinery. Such arrangements should if possible operate automatically on appearance of fire.

2.10 Efficient lighting arrangements not below the standards prescribed in the statute shall be provided and maintained at different locations in opencast mines.

2.11 Structural stability of HEMM should be examined periodically by an independent team of experts. Such an examination should invariably be made after every major repair of HEMM.

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Appendix C

Traffic Rules and Procedures

Introduction

The following rules are designed for safe operation of vehicles in and around the mine. Operators of vehicles shall observe these rules and any other special instructions given by the mine manager. The mine manager and officials appointed by him shall ensure that all persons in the mine comply with these Rules.

Rule 1 : Procedures

(a) A person shall neither drive nor operate vehicle in or about the mine unless authorised to do so for the vehicle or class of vehicles by the mine manager.

(b) A private vehicle shall not be driven in mine premises unless authorised by the mine manager or the official for the time being in-charge of the mine.

(c) Any driver not regularly working in or about the mine shall request and receive permission to enter the mine premises from mine manager or an official of the mine authorised for the purpose prior to driving a vehicle in the mine premises, which shall be prominently delineated.

Rule 2 : Speed Limits

(a) Permanent or temporary speed limits set by the mine manager for any area of the mine or any vehicle or class of vehicles shall be adhered to.

(b) Where visibility or road conditions are poor a driver shall reduce the speed of his vehicle to the extent necessary to maintain effective control.

Rule 3 : Right of Way

(a) At inter-sections which are not controlled by traffic signs, all drivers should give way to the vehicle on the right, except as stated below:

- (i) all drivers shall give way to emergency vehicles showing a flashing red light;
- (ii) vehicles being used for grading, rolling, watering and repair of roads have right of way over all vehicles except in (i) above; these vehicles will show an amber flashing light;
- (iii) light vehicles shall at all times give way to haul trucks and other heavy vehicles.
- (b) The driver of a vehicle, having right of way over another vehicle shall not endanger himself or others through insistence on that right, if this is likely, to cause a collision.

Rule 4 : Parking and standing

- (a) A driver shall not park or stand his vehicle in a position that will endanger other traffic.
- (b) A driver shall not park or stand a vehicle opposite another vehicle on a haul road.
- (c) A driver shall not park or stand his vehicle within 30m of the working area of mobile equipment or where his vehicle cannot be observed.
- (d) A driver shall not park or stand his vehicle within the area of swing of dragline without first obtaining permission from the operator.
- (e) A driver, before leaving his parked vehicle, shall ensure that the vehicle is secure, that parking brakes have been applied and that all implements have been lowered. If circumstances dictate that a heavy vehicle must be parked on a grade, then the wheels should be chocked and the steering turned offcentre.
- (f) A driver of a vehicle shall before moving from a parked position ensure that his path is free of any obstruction and/or personnel.
- (g) A driver of a light vehicle shall observe the following rules while parking his vehicle :
 - stop engine;
 - leave vehicle in first or reverse gear;
 - apply hand brake;
 - not park in front of or behind a heavy vehicle;
 - if, for maintenance or operational reasons, it is essential to park adjacent to or in close proximity to a heavy unit or shovel than allowed above, then the driver of the light vehicle shall ensure that operator of the heavy unit or shovel is fully and clearly aware of his intentions and has his permission to proceed; and
 - chock the wheels, if parked facing up or down a slope.

Rule5 : General

- (a) Vehicle shall not be driven over electric cables, air hoses or water lines unless these are properly protected.
- (b) Seat belts are to be provided for the operator's personal safety. They to be worn at all times while the vehicle is operating.
- (c) Passengers shall not be carried on any vehicle unless seated in approved seating or where authorised for training purposes by the mine manager.
- (d) A caution sign or hazard lights are to be placed at the front and rear on any vehicle which is being towed or which has broken down and is obstructing the roadway.
- (e) Operators and drivers are responsible for cleanliness, oil and water checks, tyres and fuel of machines and for keeping vehicle under their control.
- (f) Operators and drivers are responsible for ensuring that their vehicle is correctly illuminated during hours of darkness.
- (g) Headlights are to be dipped when approaching other traffic or mobile equipment in working areas.
- (h) all earth moving equipment shall sound one blast of horn before moving off from parked position.
- (i) No smoking or naked lights are permitted during re-fuelling and checking of batteries.
- (j) Trucks are to be loaded in such a manner that spillage is minimized. Loads should be centralized to maximise stability. Loads which have an overhang in excess of 1.2m shall be clearly

marked by a red flag during the day and red light at night. All roads shall be made secure for travel.

(k) The driver shall make sure that the vehicle has adequate clearance, particularly when reversing, parking, passing other vehicles and units or passing stationary and static equipment.

Rule 6 : Overtaking

(a) The driver of a vehicle may overtake any other vehicle with caution provided:

(i) the speed limit is not exceeded,

(ii) there is sufficient visibility of the road ahead,

(iii) the vehicles are clear of any road intersection or junction. .

(b) The driver of a heavy vehicle may not overtake another vehicle on an incline unless the overtaken vehicle is travelling at a speed less than 10 km/hour and there is adequate visibility of the road ahead.

(c) No overtaking is permitted in the vicinity of road dividers.

(d) While driving behind a haul truck, the driver shall ensure that he is visible in the rear view mirror until he pulls out to overtake.

Rule 7 : Signs

(a) All signs are to be obeyed. If in doubt about the intent or validity of a sign, contact an official of the mine, in-charge of the part of the mine, where the sign is displayed.

(b) Temporary signs shall be removed as soon as possible after need for them ceases to exist.

(c) Warning signs are to be noted at all times.

Rule 8 : Mechanical condition of vehicles .

(a) The driver of each heavy vehicle in use shall atleast daily examine his machine to ensure that it is in safe working order and make a written record of the results of such examination.

(b) The driver of any vehicle shall report to his supervisor any defect in the vehicle as well as damage to the vehicle or injury to himself or passengers, or near miss, arising out of a vehicle incident on the mine.

Rule 9 : Definitions

(a) The following vehicles shall be classified as heavy vehicles:

-haul trucks

-scrapers

-ANFO trucks

-fuel & water trucks

-wheel dozers and loaders

-buses

b) The following vehicles shall be classified as light vehicles:

-Jeeps/Land Rovers/Maruti Gypsies

-Station Wagons.

Appendix D

Code of Practice for Prevention of Injuries to persons Engaged in Tipping & on Stockpiles and Dumping of Overburden in Aboveground Mines

Preamble

Injuries to persons engaged in or associated with the operation of tipping on stockpiles or dumping of over-burden in mines are not common. However, when they do occur, the injuries are often serious causing temporary or permanent disability, and sometimes are fatal.

This Code of Practice has been prepared to assist in prevention of these injuries. The Code describes principles and practices which must be put into effect and strictly observed by the management and operators.

For the Code to be fully effective, it is necessary that operating instructions are prepared and are available for reference and training purposes. The instructions are to be as per requirement at each mine as conditions at mines differ markedly and, over a period of time at the same mine.

Part 1 : Objectives, implementation of code

1.1 The objectives are: (i) to prevent accidents and injuries which might occur through the operation of tipping on stockpiles and dumping of overburden, (ii) to obtain information on actual and potential hazards and unsafe workings contributing to accidents and injuries.

1.2 This Code recognises that conditions and circumstances which determine operating procedures vary considerably at different mines and over a period of time at any one mine. For the implementation of this Code, it is a requirement that written operating instructions be prepared at each mine and every operator at that mine be issued with a copy of the instructions and undergo a practical test.

Part 2 : Hazards of stockpiling and dumping

2.1 The hazards depend on the nature of the mined material being stockpiled or dumped, the configuration of stockpile or dump, the mobile equipment, highway delivery vehicles, the immediate and overhead environment, rain soaked stockpiles or dumped materials, and in raw feed stockpiles the hazard of undetonated explosives. The hazards can result in equipment and vehicles going over faces, slipping down wet subsided edges, rolling over, impact with other equipment or person, electrical contact or any combination of these.

2.2 The causes of accidents and injuries can be unstable stockpile and dump surfaces and faces, uneven surfaces, restricted access and egress, equipment and vehicle failure, unsafe working practices and procedures, and contact with power lines.

Part 3 : Responsibilities

3.1 Mine Manager

The Manager is responsible for implementing matters covered by this Code of Practice. In particular he is responsible either personally or by nomination of a competent person, for ensuring that:

- (i) written operating instructions are prepared, and available for reference and training,
 - (ii) operators are trained in the procedures,
 - (iii) operating instructions are strictly enforced;
 - (iv) stockpiles and dumps are properly sited, .-
 - (v) stockpiles and dumps are in a stable condition,
 - (vi) suitably qualified persons are employed or engaged to ensure that the requirements are met.
- Specifically, the manager or his representative will inspect all stockpiles and dumps once a week and after long periods of continuous rain or after torrential downpours of rain. The manager will ensure that at times of instability during formation of or extraction from the stockpile or dump, there will be strict supervision of the operations.

3.2 Foremen / supervisors/delegated persons

The foremen/supervisors/delegated persons having operational responsibilities associated with stockpiles and dumps will oversee and apply those aspects of the Code that relate to their responsibility.

3.3 Employees/operators/contractors

Employees/Operators/Contractors at stockpiles are responsible to comply with this Code and the written operating instructions. They must immediately report unsafe conditions at the stockpile and of mobile equipment and highway delivery vehicles to the mine manager or foreman/supervisor.

Part 4 : Operating instructions and training

4.1 At all mines where tipping or dumping is a part of normal operations, there will be prepared operating instructions. These instructions will detail the procedures to be carried out during the operation.

4.2 The manager is responsible for preparing the instruction and ensuring that they are applicable to the current operations.

4.3 The instructions will be displayed on a notice board and be available to all persons at the mine and be used for training and supervision purposes.

4.4 No operator will be engaged in tipping or dumping operations until he has received satisfactory training in the instructions and he has demonstrated by practical tests, his competency in tipping

and his knowledge of the instructions. It is the manager's responsibility to ensure this on-site training and testing has been performed.

Part 5 : Characteristics of stockpiles and dumps

5.1 Characteristics of stockpiles are significant when determining and assessing the hazards and degree of risk. The characteristics are determined by first nature of the stockpile or dump in relation to its height and methods of tipping and dumping ; second, nature of the quarried material being stockpiled or dumped , and third, characteristics of the site.

5.2 five main methods of operations are:

- (i) by moving stacker-This is a conveyor stacker mounted on wheels which moves in a semi-circle. This type of operation has a few hazards, one being to interfere with vehicle /equipment movement, another is walking or driving under stacker.
- (ii) on ground- The use by mobile equipment or by highway delivery. The hazards are not having adequate area for movement of equipment performing the tipping, particularly where there is a nearby quarry face, mobile equipment or vehicles coming in to impact and uneven surfaces.
- (iii) on stockpiles and dumps up to 6m in height -. The tipping is on a stockpile. The hazards are rollover, either by unstable surface edges or uneven surfaces.
- (iv) on stockpiles and dumps over 6m in height- The hazards are as in 5.2 (iii); however, more serious injuries are likely to occur because of the height of roll-over.
- (v) over faces- tipping is over a quarry face. The hazard is as in 5.2(iii) ; however, the fall is considerable with higher possibility of serious Injury. A hazard exists for persons working In proximity to the base of the face also.

5.3 the nature of the mined material being stockpiled or dumped is divided into three broad categories, namely,

- (i) generally unstable e.g. aggregate, sand. This product does not compact and form a compact surface. Under-cutting of the toe by a front end loader does not result in formation of an acute angle of the face. The hazards are roll-over due to an unstable edge or sides of the stockpile.
- (ii) generally stable e.g. road pavement material, dust, shale, overburden. The product does compact. Loading from the toe of the stockpile may result in formation of an acute angle of the face at the edge. The hazard is a rollover from an unstable edge.
- (iii) non putrescible waste Where this is being dumped, the hazard of rapid subsidence may be present which may cause roll overs.

Part 6 : Siting and types of stockpiles and dumps

6.1 Siting and type of a stockpile or dump is a responsibility of the manager and owner.

6.2 Factors determining the siting and types are:

- (i) nature of the mined material;
- (ii) ground used for the stockpile or dump;
- (iii) volume of product being used, moved and held;
- (iv) size of area available and required, including allowance for traffic plan;
- (v) other potential hazards i.e. power lines, high winds;
- (vi) environmental considerations.

6.3 Nature of quarried material. Refer Section 5.3. .

6.4 Ground conditions. The ground should be selected using the criteria:

- (i) the ground should be firm and provide a stable foundation.
- (ii) the surrounding ground should be firm and stable and sufficient to hold the weight and resist the vibration of operating heavy mobile-equipment, particularly if there is a nearby quarry face or water course;
- (iii) water courses, either natural or as a result of a torrential downpour, should not be adjacent to the stockpile or dump;
- (iv) adequate drainage should be provided.

6.5 Volume of product through-put of the quarry will have an influence on the siting, type and size of stockpile.

6.6 Area available and required The area available at a mine will influence type of stockpile or dump. In some mines it is not possible to perform ground tipping or dumping because of lack of sufficient available area.

Size of the area, irrespective of the type of stockpile, must be sufficient for:

- (i) mobile equipment to operate when loading;
- (ii) safe access of appropriate tipping and other mobile equipment, and highway delivery vehicles;
- (iii) safe access for the extraction from stockpile.

6.7 Other potential hazards These include overhead power lines and high winds:

- (i) no stockpile or dump shall be formed directly beneath overhead power lines on top of underground power lines;
- (ii) seven meters minimum horizontal distances shall apply from beneath power lines to top of any stockpile or dump;
- (iii) access to stockpiles shall not be from beneath overhead power lines;
- (iv) high stockpiles or dumps should not be located where high wind conditions may suddenly occur.

Part 7 : Mobile equipment and highway delivery vehicles, operations and operator training

7.1 Main function of mobile equipment and highway delivery vehicles is a cause of accidents occurring as a result of activities related to tipping or dumping.

7.2 A check as per the checklist, prepared by the manager, will be completed prior to start-up of equipment each day.

7.3 Specific items to be observed or installed are:

- (a) rear vision mirrors of sufficient size to simultaneously view tipping body and the contact between rear wheels and ground shall be fitted to each side of all rear dumpers and tipping trucks;
- (b) dumpers and tipping trucks operating between sunset and sunrise shall be fitted with a rear flood light of sufficient illumination capacity to provide clear vision of a distance not less than 10m.
- (c) Audible or visual reversing alarms.

7.4 Any malfunction of equipment must be immediately notified and if considered unsafe to operate, the equipment will be appropriately tagged 'Not to be used' until the malfunction is corrected.

7.5 All operators of mobile equipment must be trained in the operation of the equipment. This training should include the operating instruction at the mine.

Part 8 : Operations using mobile equipment and highway delivery vehicles

8.1 The specific hazards associated with tipping or dumping over the surface of a stockpile, whatever the height, are instability of the edge and surface. The risk is mobile equipment and highway delivery vehicles rolling over the face or on the surface.

8.2 Accidents may also occur by malfunctioning of equipment and vehicles, unsafe working practices, or climatic conditions. The latter includes slippery surfaces, high winds when hoist is in raised position, and poor visibility because of rain. Visibility may be a factor resulting from a narrow surface of the stockpile or night/dusk working. Tipping at an angle to the tip of the stockpile or dump can cause under-estimation of the distance to the tip.

8.3 Accidents may occur on the access ramp i.e. rollover.

8.4 Forming the stockpile or dump

(i) access ramps:

- (a) access must be sited to avoid possibility of impact with other mobile equipment and vehicles;
- (b) The ramp should be constructed using a front-end loader or tractor to compact the surface;
- (c) the ramp angle should be such that it is compatible for the safe use of the appropriate mobile equipment;
- (d) at edge there shall be constructed a berm.

(ii) initial tipping or dumping:

(a) the first tipplings or dumpings should be at a distance of 3m from the edge, if using a off-highway dumper. A front-end loader, bulldozer, or other similar mobile equipment pushes the product to the edge.

(b) the lead up to and the edge is compacted. but a berm is formed. This berm is 1m in width and 0.5m in height.

8.5 The method of tipping after the stockpiling or dumping is initially formed will depend on the nature of the mined material. The decision on the method will be determined by the manager.

8.6 The methods are:

(i) when the edge and surface is stable

(a) tipping by off-highway dumper or highway delivery vehicle over the edge. This is dependent on the use of a berm, or

(b) tipping by off-highway dumper or highway delivery vehicle prior to the edge and then pushed over;

(ii) when the edge and/or surface is unstable, Method 8.6 (i) (b) shall be used.

8.7 Non operational areas will be designated by a berm of at least 2m in height.

8.8 Unstable surfaces or edges will be designated by flags, posts, signs or any other suitable material and will be so located to warn operators not to operate mobile equipment or vehicles on these surfaces.

8.9 Operating practices of tipper operator:

(i) On entering a tipping area the tipper operator should visually check the general area of the tip specially in the dumping area. All care must be taken regarding the positioning of the truck's rear wheels at the tipping face. A truck should not be back up to an area which has not been visually inspected by the operator.

Points to watch for are:

(a) spillage

(b) soft spots

(c) berm (height)

(d) undercutting or cracking

(ii) When tipping commences in a new area, the material should be dumped short of the tipping face and pushed up by a bulldozer to form a berm at the edge of the tip.

(iii) When dumping in an area where no berm is present (for example: the construction of a new haul road where material would be laid down in layers), the material must be tipped short of any edge and pushed into position by a bulldozer.

(iv) At the edge of the tip, a safety berm is to be left by the bulldozer operator. This berm shall be formed from the tipped material and have a height equivalent to half the wheel diameter of the trucks dumping. In any event, this berm should not be less than one meter in height.

(v) After positioning his equipment for tipping or dumping, the operator will raise the hoist with the equipment stationary. The hoist must be completely lowered after the operation of tipping or dumping. During these operations the operator will remain in the cabin.

(vi) if at any time the operator considers the operation unsafe, this should be immediately reported to the manager and/or foreman/supervisor.

(vii) Joint special inspections with supervisor shall be made after heavy or prolonged rain.

Part 9 : Tipping and dumping over mine face

9.1 The hazards are the same as for tipping or dumping. The risk of serious injury is greater because of the acute angle of the face.

APPENDIX I
Pre-start Check

Prior to starting mobile equipment for daily operations, a check will be undertaken. The check will include:

- | | |
|---------------|--|
| 1. Cabin | Seats and safety belts/harness, Loose tools, equipment and other articles are secured. Remove unnecessary materials/objects. |
| 2. Levels | Oil, fuel and coolant levels. |
| 3. Pressure | Tyre pressure. |
| 4. Visibility | Warning devices including turning indicators are working.
Headlamps works. Windscreens and side windows clean. |
| 5. Controls | Brakes
Steering
Accelerator/decelerator. Instruments and gauges. |
| 6. Lifting | Hydraulics
Winches and cables
Elevator and hoists |
| 7. Engine | Operation |
| 8. Other | Cutting edges, teeth wear and damage
Vandalism
Persons not working under equipment |

Accidents due to tippers in opencast mines

Accidents due to tippers in small and medium sized opencast mines, specially where the vehicles are plying over hilly terrain, have considerably increased in the recent past. Enquiries into the above accidents have revealed that, Most of the accidents took place while going down the gradient with load. In dumpers, retarders are provided to slow down the speed of the engine in such cases. In tippers, manufacturers are now providing exhaust brake as an extra fitment which on application, closes the exhaust of the engine and simultaneously the fuel system to the engine is stopped. The engine starts behaving like compressor which reduces the speed considerably. Fitment of exhaust brake shall henceforth be made mandatory in all tippers. The new tippers to be procured shall be fitted with exhaust brake and action shall be taken to fit exhaust brakes in the existing tippers within a specified time

frame but not later than one year from the date of issue of this circular.

In addition, parking brake and service brake of tippers shall be maintained in safe working order as per the guideline vide Cir. Tech. 3 of 1981. The following precautions/actions shall also be taken-

(i) While going down the gradient, the driver must lower the tipper with engine 'ON' and gears be kept in maximum speed reduction stage. All drivers should be given adequate vocational training about driving in hilly areas/downhill movement.

(ii) Management must take proper responsibility for road worthiness of all contractors' vehicles before deploying them in the mines.

(iii) Ramps with 1 in 10 gradient should not be more than 10 metres at one stretch.

(iv) Starting of the tipper by self starter is mandatory. Push starting shall be totally prohibited.

The above mentioned precautions may help reduction of accidents due to tippers. Hence, the recommendation may be strictly complied with in the interest of safety.

(Cir. Tech. 2/2004)

Precautions while working near high benches in open cast mines

several accidents take place every year in opencast mines when persons working near the edges of benches lose balance or slip and fall to the lower benches. In many of such accidents, the persons involved are engaged in levering out boulders or large rock or ore pieces with the help of crowbars.

In some cases death has resulted due to a vertical fall of only about 1.5m on hard ground or on broken strata. Due to routine nature of job, a sense of complacency develops and the dangers involved in such operations are lost sight of and adequate precautions are not taken.

Such accidents can be averted by the use of proper type of safety belts or safety ropes. It is to impress upon you that whenever persons are engaged near quarry edges or edge of a bench from which they are likely to fall down, they should invariably be provided with safety ropes or belts. The supervisory officials shall ensure that the same are used.

(Cir. Tech. 12/1982)

Accident due to side fall and fall of persons in opencast mines during monsoon season

Analysis of 288 fatal accidents that occurred in non-coal mines during last five years (1999-2003) has revealed the following:

cause	No. of accidents	percentage
Dumpers and trucks	74	25
Fall of persons	51	18
Side fall	46	16
Explosive	31	11
Fall of objects	13	5
Roof fall	7	2
Others	66	23
total	288	

From the above, it is observed that fall of side and fall of person together accounts for 97 accidents i.e. 34% of all accidents, which occurred mostly during monsoon months. Such accidents occur mainly due to –

- (1) Non-formation of proper benches and non maintenance of slopes, especially in overburden consisting of alluvial soil, murrum, gravel, clay, debris or other similar ground.
- (2) Formation of undercuts causing overhangs.
- (3) Working near the edges of high benches without wearing safety belts.

It has been observed that during normal season high benches are stable and tolerate certain amount of under-cut. but during monsoon season, specially after the first shower, the ground is likely to be soaked with rainwater. Cracks and crevices which are created by mining also get filled with water. The slope faces are subjected to high water pressure leading to collapse of side causing accidents to persons engaged at the bottom of the bench and / or persons engaged at the edge of the quarry.

The persons engaged thereat are ignorant about the dangers about the changed situation due to routine nature of job and sense of complacency and try to work in normal way ending up with accident.

In a few cases loose boulders / rocks which are not cleared and kept away from the edges of the quarry have rolled over and fallen on the person engaged at the bottom of the bench. Similar is the case with those who are engaged at the edge of the high benches.

To avoid such accidents adequate provisions have been provided under Regulation 106 of MMR, 1961 and Regulation 98 of CMR, 1957, which are not generally being followed wherever such accidents have occurred. therefore once again it is impressed upon all concerned, of open cast

coal and non-coal mines, particularly small mine operators, working in stone, marbles clay, sand stone, slate, limestone, iron ore etc. to pay adequate attention to:

- (1) Formation of proper benches as specified under Regulation 106 of MMR, 1961 /98 of CMR, 1957.
- (2) Dressing and making the sides of benches secure before employing persons.
- (3) Cleaning loose stones and debris lying within 3m from the edge of the benches.
- (4) Not allowing any persons to work at the edge of the bench/quarry without wearing a safety belt fully secured.
- (5) Not allowing any persons to do under cutting of the face/side so as to form overhang.
- (6) Caution all persons working at the quarry regarding failure of benches due to rain water and its consequences.
- (7) Construction and maintenance of garland drains around the excavation before the onset of monsoon to divert the rain water away from the pit.

It is expected that if above precautions are taken and efforts are made to ensure strict compliance of law, accidents due to side fall and fall of persons from the benches in open cast mines can be prevented.

(Cir. Tech. 7/2004)

Accident due to fall of persons while working at height.

Increasing number of fatal accidents due to fall from height has been a matter of concern for quite some time. Recently, a worker engaged by contractor lost his life by falling from a height of 10.8m while he was engaged in painting purling at the roof level of a workshop in an opencast coal mine. While at work with a safety belt the deceased who was standing precariously on a projected bamboo fixed at its end to a steel truss, lost his balance and fell down. The resultant jerks severed the safety belt causing his free fall.

Inquiry into the accident revealed failure to comply with some elementary safety precautions like providing platform/stage or scaffold, ensuring use of approved and well-maintained safety belt etc.

In order to prevent such type of accident in future you are requested to take following steps in addition to the prevalent practices and procedures.

- (i) A working platform/stage or scaffold of adequate width with proper fencing shall be provided. A safe means of access to the working platform shall be provided.
- (ii) Only approved type of safety belt or life line conforming to Indian Standard IS:3520-1999 shall be used which shall be properly maintained and checked for its fitness before every use.
- (iii) A code of safe procedure shall be prepared and implemented for such type of dangerous jobs which amongst others may include training of persons, supervision before engaging contractual persons etc.

The matter may be brought to the notice of all concerned under your charge for strict compliance.

(Cir.Tech. 3/2006)

Transportation of mineral or material by tractor-trailer combinations in opencast mines

In a mechanized open cast mine a fatal accident occurred under the following circumstances-

"A tractor connected to a two-wheeled trailer was going down a haul road dipping, at 1 in 6 when the brakes failed causing runaway. A miner who was working nearby was hit by the tractor as well as trailer and sustained serious injuries which turned fatal after three hours."

To avoid such accidents the following measures are suggested-

- (i) no tractor-trailer combination shall be operated on gradient greater than 1 in 14.
- (ii) trailers having four or more wheels shall only be deployed in mines. Two-wheeled trailers, which are in use at present, should be gradually phased out and by the end of the year 1987 no such vehicle should be in use.
- (iii) trailers shall be provided with hydraulic brake in addition to hand brake.

(iv) the coupling between a tractor and its trailer shall be of adequate strength and sound in construction . such couplings shall have suitable locking arrangements.

(v) hand brake be applied when a vehicle is parked. The gear shift lever shall also be engaged in levers while the vehicle is parked on down gradient or on level roads , and in low gear while it is parked on up gradient.

(vi) While a trailer is being loaded/unloaded, it shall be held by applying hand brake and also by the use of other means such as suitably designed stopper blocks placed against the tyres, etc.

(vii) a proper schedule of examination and maintenance of the tractor-trailer combination shall be adopted and record thereof maintained in a bound paged book kept for the purpose. It shall be signed and dated by the person making the examination and countersigned by the Engineer and Manager. A model schedule of examination is enclosed for guidance.

It is hoped that for the well-being of the industry and that of. the persons therein, every mine utilising tractor-trailer combination for transport of mineral and material would pay due attention to the above suggestion.

Model schedule of examination of tractor with trailer

General

The specific period has been indicated for the frequency of examinations and test, However The same can be readjusted based on actual experience of the Colliery Engineer. The checklist should be regarded as a useful guide to assist the examiner in carrying out examinations so as to achieve the basic objective of safe and efficient condition of equipment. Results of examination should be recorded in a bound paged book kept for the purpose duly checked and countersigned by colliery officials and should be produced before the inspecting officials.

It is also suggested that the check-list should be painted on a board in English , Hindi and other regional language , as the case may be , and fixed at suitable places so as to facilitate the competent person who is authorized to carry out such examinations.

Every shift

- (a) without dismantling, to verify that the machine is in efficient and safe working order is functioning correctly.
- (b) that all fittings, attachments, couplings and components are intact and free from any defect or excessive wear.
- (c) there are no bolts, studs or rivets loose or missing and that inspection covers securely in position.
- (d) that lubrication has been properly effected and all oil levels are correct, and automatic lubricating systems are operating correctly.
- (e) that there is no abnormal noise, vibration or heating particularly at bearings and gearing.
- (f) that there is no leakage of oil, air or water.
- (g) that all guards and fencings are securely in position and adequate.
- (h) fire fighting appliances are to hand and statutory notices displayed.
- (i) that the machine is reasonably clean and free from accumulation of coal dust or dirt able to operate freely.

Daily

1. fir evidence that daily servicing has been carried out satisfactorily in every shift as per the check list.
2. engine oil level.
3. radiator water level.
4. for water, oil and fuel leaks.
5. Engine oil pressure.
6. Battery charging rate and electrolyte level.
7. Tyres for damage and inflation (to manufacturer's recommended pressures).
8. Wheel nuts for tightness.
9. Efficiency of brakes.
10. Efficiency of steering.

11. Test warning devices.
12. Machine performance, cleanliness and any noticeable defects like light, wipers etc.
13. Ensure that all guards and covers are securely in position.

Weekly

1. Clean and re-oil air intake filter.
2. Lubricate all linkages.
3. Oil levels, steering box, gear box, rear axle.
4. Replace all guards and covers securely in position.
5. Check adjustment of brakes and clutch.
6. Fan belt and its tension.

Note: Any other examination shall be carried out on the basis of number of hours run as per recommendations of the manufacturer.

(Cir. Tech. 1/1987)

Accidents by consumers' trucks in mine premises

Recently there have been a few accidents caused to and by vehicles of purchasers of ore in mine premises. Such vehicles being permitted in some cases move right into the mine workings for loading of ore from the mine premises. In two such cases, persons were killed due to movement of vehicles of such consumers. As the two cases under reference indicate, the above practice is fraught with grave danger not only to persons employed in the mine

but also to persons operating such vehicles. There is no control of the management on movement of vehicles of consumers in mine workings. Further ; operators of vehicles of consumers not being familiar with the mine workings, create an unsafe condition causing accidents.

In the interest of safety of persons , therefore it is necessary that no vehicle , other than that of the mine management , is permitted to go inside the mine workings. All transportation of ore on the surface should be by vehicles and personnel under the direction , supervision and control of the management only. Sale and distribution of mineral should be from a central dispatch point. If the sale is carried out from the mine itself , siting of the central dispatch point should be such that it does not become a source of danger to persons employed in the mine.

Suitable action should be taken if the procedure adopted is different from that suggested above.

(Cir. Genl. 1/1978)

Fatal accidents caused by wheeled trackless transportation machinery in opencast metalliferous mines

Increase in opencast mining activity all over the country has unfortunately been associated with increased number of accidents in opencast mines. A large number of these accidents are caused by wheeled trackless transportation machinery. An analysis of fatal accidents during the year 1992 caused by wheeled trackless transportation machinery in opencast metalliferous mines was carried out. Some of the findings are given below:-

1. Fatal accidents due to wheeled trackless transportation machinery caused 26.4% of all fatal accidents in metalliferous mines and it contributed 34.6% of all fatal accidents in opencast and surface operations. ..
2. Unauthorized/negligent driving contributed to 33% of the accidents.
3. 27.8% of the accidents took place while reversing the vehicles. Out of these, in 60% of the cases audiovisual reversing alarms were either not provided or were not functioning.
4. 78% of the accidents took place on haul roads and in quarry operations area.
5. 16.7% of the accidents occurred due to failure of brakes.
6. 56% of the victims were not vocationally trained.

In order to control the above hazards and minimize accidents due to wheeled trackless transportation machinery, the following steps should be taken:

- (a) Recommendations of Seventh Conference on Safety in Mines (1988) regarding 'safety in opencast Mines' should be implemented at the earliest (Cir. Tech. 1/1989).
- (b) Provision of audio-visual alarm of sufficient intensity on all wheeled trackless transportation machinery must be ensured. (Cir. Tech. 7/1977)
- (c) It is disturbing to note that 56% of the victims were not vocationally trained. The need for vocational training is once again reiterated. Moreover, all persons to be employed to drive/operate dumpers/trucks etc. should be trained and their competency should be evaluated by a Board constituted by the mining company. In case of smaller mines, such arrangements may be made by association of mine operators.
- (d) Regular checking of brakes of wheeled trackless transportation machinery will go a long way in eliminating accidents due to failure of brakes. Guidelines in this regard were issued vide Cir. 1 of 1973. The programme for regular checking of brakes as per manufacturer's schedule must be implemented.

(Cir. Tech. 5/1993)

Use of tractor – trailer combination for transportation of material in opencast mines and on surface

An analysis of fatal accidents during the year 1992 revealed that there has been considerable increase in accidents due to tractor-trailer-combination. These accidents took place due to over speeding and failure of brake.

Earlier, instructions were issued for prevention of accidents due to tractor-trailer combination vide Cir. Technical 1 of 1987. The matter was also discussed in the Eighth Conference on Safety in Mines. The conference recommended that "use of tractor-trailer combination on haul roads should be discontinued. Where inevitable the trailer should have four wheels and separate brake of its own."

Doubts have been expressed regarding availability of such tractor-trailer combination having separate hydraulic brake for the trailer. In this connection H.M. T. Ltd. have informed that they have supplied such a tractor-trailer to Neyveli Lignite Corporation and the same is working satisfactorily.

In order to avoid accidents due to tractor – trailer combination, the following steps should be taken-

1. as far as practicable, tractor – trailer combination should have four wheels and separate hydraulic brake of its own such that it can be operated by the driver from his seat on the tractor.
2. the tractor operator must not overspeed the vehicle and should select proper gear while going down the gradient.
3. while towing water tanker, drill machine etc. with tractor, precautions mentioned above should be observed. Hauling capacity of the tractor should also be taken into consideration.
4. unauthorized driving of the tractor and unauthorized riding on the trailer should be strictly prohibited.

(Cir. Tech. 1/1994)

Fatal accidents to contractors' employees engaged in transportation work in mines

Waste handling jobs as well as transportation of coal/mineral from mine faces/pits to waste yards/coal dumps are being increasingly carried out by engaging contractual vehicles and workers.

Analysis of accidents due to wheeled trackless vehicles in opencast mines has revealed that:

- Approximately 33% of the accidents take place while reversing vehicles in dump yards/coal benches.
- 60-70% of the victims were either drivers or khalasis of the vehicles deployed by the contractors.
- No basic or specialized training was imparted to the contractual workers before engaging them in the mine.
- In some cases it has been observed that khalasis etc. engaged by the contractors were run over by the vehicles while sleeping in dump yards/ waste yards.

Needless to say, special attention need to be paid towards training of contractors' workers and maintenance of vehicles belonging to the contractors. Greater discipline needs to be enforced by local mine management to ensure that only duly qualified, experienced and trained workers are employed by contractors. The work of all such persons should be invariably supervised adequately by mine management.

Attention of owners, agents and managers of all mines is once more drawn to various recommendations and circulars issued earlier and enumerated below for strict compliance:

(1) recommendations of Seventh Conference on Safety in Mines in respect of 'safety in opencast mining' to be implemented without further delay. (Ref. Cir. Tech. 1 of 1989)

(2) Recommendation of Eighth Conference on Safety in Mines in respect of 'Safety in opencast and surface operations' to be implemented without further delay.

(3) recommendations of Cir.Tech. 4 of 1993 to be strictly adhered to.

(Cir. Tech. 9/1996)

Danger due to lightning/storm during blasting operation in mines

Recently, three accidents took place due to premature blasting by lightning when persons were killed / injured/escaped while they were in the process of charging explosives / connecting detonators etc. These accidents occurred as mentioned below:

(1) while 9 deep holes and a number of secondary holes were being charged to be connected in series and fired, a lightning discharge due to thunderstorm caused premature firing of the deep holes, killed three persons and inflicted serious bodily injuries to one.

(2) while a Blaster was carrying 100 primed cartridge of explosives with electric detonators in a card-board box on his shoulder, the cartridges exploded suddenly resulting in instant death of the Blaster.

(3) while a Blaster and his helpers were about to take shelter after charging of the holes, suddenly there was a lightning/thunder-storm resulting in, premature blast of the holes. Persons escaped unhurt.

Accidents due to above causes continue to occur despite very clear safety precautions laid down while granting permission under Reg. 106 (2) (b) of MMR 1961 and Reg. 98 of CMR 1957 and also circulars issued by DGMS recommending additional precautions to prevent such accidents.

These precautions in brief are given below :

(i) shots shall not be fired except during the hours of daylight or until adequate artificial light is provided; all holes charged on any one day shall be fired on the same day as far as practicable.

(ii) as far as practicable, shotfiring shall be carried out either between shifts or during the rest interval or at the end of work for the day.

During the approach and progress of an electric storm, the following precautions shall be taken:

(a) neither explosives nor detonators shall be handled;

(b) if charging operations have been commenced, the work shall be discontinued until the storm has passed;

- (c) if the blast is to be fired electrically, all exposed wires shall be coiled up and, if possible, placed in the mouth of the holes or kept covered by something other than a metal plate,
- (d) all wires shall be removed from contact with the steel rails of a haulage track, so as to prevent the charge being exploded prematurely by a local strike of the lightning;
- (e) if the firing circuit has been set up before the thunderstorm came on, the persons at the site should withdraw at the earliest and the blast should be fired off immediately;
- (f) all persons shall be withdrawn from the danger zone.

(Cir. Tech. 1/1995)

Accidents due to dumpers: sudden stoppage of engine and failure of braking system

In an opencast coal mine a 35 tonne Haul-pak dumper travelling against a gradient of 1 in 10 rolled back and fell down to the lower bench causing fatal injuries to the operator. Enquiry revealed that engine of the dumper stopped suddenly of its own and due to non/partial functioning of the brake and non functioning of the emergency steering system, the operator failed or became rather helpless to control backward movement of the dumper.

In such dumpers the steering system and the power transmission system are hydraulically operated. On stoppage of engine, hydraulic pressure comes to zero almost instantaneously, hydraulically operated steering gets locked and the gear system becomes as if kept in NEUTRAL position. Hence the vehicle (when moving against the gradient) starts going back. In such cases, effective parking brake/service brake and secondary braking system having no leakage in the pneumatic system can only save the vehicle from going back. Battery operated emergency steering provided in such Dumpers also can be useful for controlling the vehicle if the driver can keep himself cool as he has to switch on the emergency/steering circuit manually.

It is therefore necessary to maintain parking brake/service brake and secondary braking system and emergency unit in all Dumpers in safe working order to avoid accidents. It is necessary that these systems are more frequently examined and records of such examinations are also maintained. In this connection I like to draw your attention to Cir. Tech. 3 of 1981 wherein the importance and methods for testing of parking brake and service brake have been highlighted.

Accidents due to HEMM are on the rise due to increased activities in the opencast mining sector. Hence the above recommendations must be strictly complied with in consultation with the equipment manufacturers.

(Cir. Tech. 3/1999)

Accidents due to failure of brake in tippers (tipping trucks)

Tippers (tipping trucks) are being increasingly used for transport of coal/mineral, waste material in opencast mines. These tippers are provided with service brake which operate by air over hydraulic pressure and parking brake released by air pressure. Such tippers cause a number of accidents every year due to failure of brakes particularly where a vehicle is plying on gradient.

Inspections made by officers of this Directorate have revealed that parking brakes which could stop the tipper in case of failure of service brakes were found defunct in most of the tippers.

Therefore in case of failure of service brakes on gradient, the tippers rolled down causing accidents.

Parking brake in general is understood as a brake meant to hold a stationary vehicle in stopped condition. But most of the manufacturer now provide parking brakes which can stop a moving vehicle in case of failure of service brakes.

Some of the models of tippers (e.g. TELCO Model 1210 of 1992) are provided with fail safe parking brakes; in some other models of tippers e.g. Tata 1510 & 1510A, the manufacturer can provide full air brake system on request of purchasers. In case of leakage of air pressure or

pressure drop in air system in these models , the brakes are automatically applied on all the four wheels. Ashok Leyland also provides this type of braking system on 'Comet' model tippers. To prevent accidents due to failure of brakes, you are requested to get the tippers regularly checked for the braking system including parking brakes and; ensure that the same are maintained in order. Action may also be taken to introduce tippers with full air brake system (and not air over hydraulic oil) in which the tipper stops immediately if the air pressure drops in the brake system.

(Cir. Tech. 9/1999)

Provisions of propeller shaft guard in Dumpers and Tippers

While a tipping truck loaded with coal was being driven up a haul road at a gradient of 1 in 16 in an opencast mine, the propeller shaft suddenly broke, damaging the service brake. The tipper rolled back for a distance and fell down in 5m deep waterlogged ditch causing fatal injuries to the driver. There are several cases in which due to a mechanical failure (such as shearing of bolts etc. at the rear end of propeller shaft) , the shaft would become free to dangle and consequently spin violently over a wide area and thus smash the brake system components (servo chambers , master cylinders as well as pneumatic and hydraulic lines) which are in the vicinity and this damage would in turn result almost immediately in brake failure.

To prevent possibility of failure In the above situation, BEML has provided a sturdy safety guard for the propeller shaft in BH-36 dumpers. These are simple in design and can be adopted to any type of dumpers easily.

In this connection attention is drawn to the Cir. Tech. 3 of 1999. wherein the importance of other safety devices has also been highlighted. Hence it is recommended that the sturdy propeller shaft guard shall be provided in all types of Dumpers and tippers irrespective of tonnage / capacity in consultation with equipment manufacturers.

(Cir. Tech. 10/1999)

Provision of proper Audio Visual Alarm during reversing of vehicles

Occurrence of accidents due to dumpers, tippers, trucks and other surface transportation machinery during reversing still remains a matter of concern. In the past, attention was drawn vide Cir. Tech. 7 of 1977 and 12 of 1999 but it is revealed during inspections that in many dumpers and tippers, still audio visual alarms (to be actuated automatically while reversing) have not been provided, and wherever provided, most of them were found nonfunctional. It is also learnt that audio visual alarm sets cannot cope up with the vibration dusty condition and rain water/other water sources used for cleaning.

It is, therefore, recommended that no dumper and tipper, henceforth, shall be allowed to be in use without providing reliable type of audio visual alarm to be actuated automatically during reversing.

The following specifications of such audio visual alarm are recommended.

(1) The audio visual alarm (A. V.A.) shall conform to IS 13947(Part 1) of 1993 for the following protection against dust and water:

Degree of protection

Test conditions as per
IS 13947 (Part I)
sub clause

- | | |
|--|---------------|
| (i) Protected against dust and shall prevent ingress of dust - | C 7.5 & C 7.6 |
| (ii) Protected against dripping water..... | C 8.1 |
| (iii) Protected against spraying water..... | C 8.3 |
| (iv) Protected against splashing water | C 8.4 |

(2) Such audio visual alarm shall also conform to IS 13109 (Part I) of 1991 for the following environmental requirements;

Test	Test conditions
(1) Vibration Test	As per Table I of IS 13109 (Part I) of 1991
(2) Shock Test	
(3) Bump Test	
(4) Drop and Topple Test	
(5) Cold Test	

(3) The above tests (as per BIS 13947 & 13109) carried out as per SAE 1994 may also be accepted. In addition, the following Endurance Test of A. V.A. may be carried out as a type test in accordance with SAE 1994.

The details of SAE 1994 are given below: -

(Title -Alarm-Back up -Electric Laboratory -Performance testing,

Publication date -08.01.1993

Publisher -Society of Automotive Engineers. U.S.A.)

Test	Test Conditions
(a) Endurance Test at High Temperature	As per para 7.1
(b) Endurance Test at Room Temperature	and para 7.2

(4) Sound levels to be checked before and after the above tests.

Sound level to be checked as described in SAE 1994 Standard. Sound level after the test shall be within +/- 5 dBA of the value for which the equipment is designed.

(5) Allowable Sound Level:

The sound of the Audio visual alarm, should be more than the surrounding noise level so that It can be heard distinctly. Since the reversing process normally takes 2 to 3 minutes , 110 dB(A) sound level is recommended for Audio visual alarm. Self adjusting back up alarm may be preferred where the sound level is automatically maintained at 5 dB (A) higher level than the surrounding noise level.

(6) Protection against splashing of mud and water on the pressure switch shall be provided by the HEMM manufacturer/used industry.

(7) Mechanical Lock may be provided to prevent unauthorized tampering of the alarm.

(8) Test facilities for the above tests are available in C.M.R.I., Dhanbad, and in other B.I.S. approved test houses. Fresh test report for every major lot should be insisted.

You are requested with comply to these recommendations in the interest of safety.

(Cir. Tech. 9/2003)

Precautions to be observed during the operation and maintenance of Derrick Cranes.

An accident occurred recently in a marble mine where a derrick crane, while lifting load, fell down into a pit, along with its operator, killing him instantly. Enquiry into this accident revealed that cracks had developed in the welded joint of jib plates of derrick crane. About 50% of the joint was found to be rested. The plate therefore came out of the joint and crane fell down in the pit. Fabrication of derrick cranes involves welding of structures and in due course of time cranes are likely to develop at welded joints due to fatigue and shock loads.

The enquiry further revealed that although the manufactures had recommended that the jib should not be lowered beyond 15 degrees, this was not compiled and this accident occurred when the jib was almost horizontal in the process of lifting the load.

In order to avoid similar accidents in future, you are advised to implement the following:

1. The welded joints of the structure of derrick crane should be examined by 'Die- penetration Test' method, once in at least three months and by 'Magnetic Particles' testing method, once in a year. This test shall be conducted by any Govt. Test house or any other DGMS approved Test houses.
2. Limit switches should be provided to restrict movements of jib within the safe permissible limits.

3. While lifting the marble blocks, it should be ensured that these are not dragged along the ground, during the process of lifting by the derrick cranes so as to prevent additional stress on the structure and swinging of marble blocks after lifting.

Management of Marble mines are requested to comply with the above recommendations in the interest of Safety.

(Cir. Tech. 5/2004)

Preventing fires in Heavy Earth Moving Machineries.

In the recent past there have been instances and reports of fire in HEMM with the increase in output; use of costly and large size HEMM has become imperative. Installation of automatic fire fighting systems in such Heavy Earth Moving Machines as required by Circular No. 3 of 1981 needs no emphasis. In a recent fire incident in HEMM that took place in a heavily mechanized OC mine it was revealed that while a 35 T articulated dumper was hauling load of ore from the face to the top on the haulage road, the hydraulic oil from the return hose in the engine house spilled on to the hot exhaust pipe and it caught fire. The carriage and the cabin of the dumper were burnt. Had the oil carrying hoses in the engine house been housed separately and away from the hot parts of the engine the incident would have been averted. The costly articulated dumper met the fate because neither the oil bearing hoses were compartmentalized nor the hot parts of the engine room were insulated in a manner not to ignite oil. To avoid / fight such fire, the following recommendations are being made:-

1. This incident highlights that the oil- bearing hosepipes should be housed separately and away from the hot parts of the engine like turbocharger, exhaust and manifold. Simultaneously the hot parts of the engine should be insulated in a manner so that even if oil is spilled on them, it does not come in contact with the hot parts of the engine.

2. user Industry should also ensure that henceforth OEM of HEMM should provide proper type of automatic fire detection and suppression system (AFDSS) in all HEMM with recommendations for periodical testing procedure and maintenance schedule. In all existing shovels and dumpers for 50 tonne capacity and above, user industry must provide suitable AFDSS where OEM has not supplied AFDSS with the equipment. All AFDSS shall be maintained in safe working order in such dumpers / HEMM. Maintenance of such automatic fire detection and suppression system be carried out by the experts specially trained for the purpose.

3. In small dumpers and other HEMM like excavator etc. where OEM may not be in a position to provide automatic fire fighting arrangement with the equipment in near future, user Industry shall provide semi automatic fire fighting arrangement in such dumpers/ HEMM. Such system has been locally developed by M/s Sesa Goa Iron Ore Mines and M/s Western Coalfields Limited by providing 4/5 discharge nozzles at the vulnerable points in the engine room of the machine using dry chemical powder propelled by Nitrogen or Carbon-dioxide of system. In case of fire, the operator has to actuate a knob located near his sitting arrangement. Such semi automatic fire fighting arrangements are also available indigenously.

4. All high pressure hydraulic hose fitted in the engine room must conform to the specification as laid down by the OEM and their quality to be ensured. The hoses shall be replaced at the prescribed interval or earlier if there is any sign of deterioration.

5. User industry shall henceforth report any incident of fire in HEMM to the Regional Inspector of Mines Safety so that the matter is studied in depth to take corrective actions.

6 Although some of the manufactures of Heavy Moving Machineries have tried to cover this potent source of danger in the inherent manufacturing process, nevertheless such fires highlight the need to review from design as well as maintenance angle.

(Cir. Tech. 10/2004)

MMR 118

Identification for newly recruited inexperienced mine workers.

A person newly recruited for mine employment in a mine do not possess any knowledge of mining activities and is therefore, exposed to dangers & hazards in the same. According to Regulation 115(9) of the Coal Mines Regulations, 1957, and Regulation 118 (10) of the Metalliferous Mines Regulations 1961, an inexperienced person shall not be allowed to work alone without presence/ guidance of an experienced worker so as to ensure the safety of new worker. It is necessary that every new person shall be given initial training as per the Mines Vocational Training Rules, 1966 to develop necessary and requisite skill and safety awareness on him. The new worker should be aware of the various dangers involved in different types of operations. No inexperienced worker should be allowed to work any particular job unless he has been trained thoroughly in safe work procedure related to that job. In view of the above, every newly recruited mine worker shall be issued a coloured helmet of a distinct colour, one different from those worn by experienced mine workers. He shall wear this distinctively coloured helmet all time while at work in or around a mine for at least one year from the date of initial employment. The coloured helmet should bear luminous markings/strips for ready identification while at work in the dark. By introducing the system, the newly recruited mine workers can be easily and readily identified by these distinctively coloured helmets (preferably written N.E.W. newly employed worker). Competent persons

and mine officials shall help to develop/ inculcate safety consciousness and safety awareness in them from the very beginning of their employment. Mine officials shall take care of, watch and guide the new workers to discharge their duties safely. You are requested to take appropriate action in the matter at the earliest and ensure that all newly recruited mine workers are issued with distinctively coloured helmets and to ensure that they wear them at all times.

(Cir. Genl.(S&T) 9/1997)

MMR 124

Suppression of mine dust by using ionizers 'Pulver Bond' and 'Dust Bond'

1.0 Introduction

Most mining operations produce dust which, when airborne becomes a serious hazard to the health of workers and equipment/machines. Besides, coal dust which is inflammable, may also lead to disastrous explosion. In recent times with introduction of mechanisation both in opencast and underground mines, it has become a bigger danger than ever before since operations of machines usually throw up much more dust as compared to hand operations. Dust of any kind of sufficiently fine quality when inhaled in large quantities may lead to development of respiratory diseases such as pneumoconiosis and silicosis etc. Sizeable amounts of dust are also produced and are rendered air borne in and around haul roads in opencast mines during material transportation by dumpers, conveyors etc. Fine dust rendered air borne remains in the atmosphere for a considerable length of time positively polluting the environment. The best method of preventing roadway dust getting air borne is to consolidate it by wetting the dust with water sprays, but water spray alone do not produce good wetting of all deposited dust and large quantities of water may be needed frequently for producing effective results due to propensity of water to evaporate in hot and dry conditions. Wetting Agent, if added, would increase the ability of water to consolidate and hold together the smaller dust particles.

This Directorate, vide Cir. No. 31 and 62 of 1966, and Cir. No. 40 of 1967, had advised the industry to use Wetting Agents for effective suppression of dust. These wetting agents were either syrupy liquid or non-ionic detergents and did not form ionized emulsion and thus were not very effective for consolidation of loose dust in order to ultimately prevent it from being airborne.

Due to limited availability of Wetting Agents along with the absence of methodology of correct treatment, dosages etc., and non-availability of sufficient water, the industry had not responded to the advice and standard of dust suppression remains unsatisfactory.

To overcome the above difficulties, the Research Institutes have carried out experiments with Ionized Emulsion for development of cost effective suitable Dust-Settling-Ionizer for effective dust suppression/dust consolidation including airborne dust for both opencast and underground mines.

2.0 Principle of Operation

A dilution of an Ionized Emulsion with positive and negative charged ions when sprayed in/on dusty atmosphere, binds the small charged particles together to large particles suspended in air and brings them down to settle on surface and remain there for a long time. The dust suppression material is thus able to encrust surface dust and reduce the concentration of airborne dust.

3.0 Methodology of Application

About 10 to 20 applications would be required in a cyclic manner for efficient dust suppression. Each application is required to be done in two weeks followed by daily watering. Requirement of water would gradually decrease over the period of time.

4.0 Properties

The Dust Settling Ionizer should have the following characteristics :

- (1) flash point of Ionizer should be more than 175°C;
- (2) it should be non-toxic and hygroscopic in nature, and
- (3) it should be effective to conglomerate fine dust including airborne dust.

Field Trials of Dust Settling Ionizer have been carried out by the managements of some coal companies in the opencast mines under the guidance of CMRI. "Pulver Bond" and "Dust Bond"- two Dust Settling Ionizers manufactured by M/s PVR Inshield Bituminous PVI. Ltd., P.O. Dishergarh, Distt. Burdwan, W. Bengal and M/s Calcutta Mining Sealants Pvt. Ltd., P.O. Dishergarh, Distt. Burdwan, W. Bengal respectively possess the above characteristics and have been used for dust suppression in opencast mines. Pulver Bond passed different tests carried out by Indian School of Mines, Dhanbad and Dust Bond also passed same type of tests carried out by CMRI, Dhanbad.

It is therefore recommended that a Dust Settling Ionizer may be used under all circumstances for dust suppression including airborne dust in opencast mines to start with.

We would be pleased to get a feedback on action taken in the matter alongwith recommendations, if any, for improvement of the situation further in our mechanised opencast mines.

(Cir. Tech. 8/1997)

Sampling of air borne Respirable dust levels in mine atmosphere

DGMS (Tech.) Circular No. 5 of 1988 specifies guide lines for conducting air-borne dust surveys in mines. As per the guide lines NCB/MRE dust sampler type 113A or its approved equivalent is to be used for fixed/static dust sampling which will mainly give the assessment of airborne respirable dust in work place environment. Apart from static sampling, Personal dust samplers are also used for assessing the dust dose of an individual during a shift.

It has been brought to the notice of the undersigned that M/s Casella, London, the only manufacturer of MRE-113A Gravimetric dust sampler had stopped manufacturing and as such procurement/maintenance of this sampler is becoming difficult. At present no other approved type of static sampler is available in the market.

The matter has been examined, in light of present non-availability of any approved type of static sampler in the market. In order to tide over the problem as of now, it has been decided to temporarily permit use of Personal dust samplers for the purpose of carrying out airborne respirable dust survey in mines as static sampler as required under Regulation 123 of the Coal Mines Regulations, 1957 and Regulation 124 of the Metalliferous Mines Regulations, 1961 for a period of two years.

The Personal dust samplers to be used for the purpose shall function on the principle of gravimetric separation and shall be able to give an equivalent concentration as measured with an MRE-113A Gravimetric dust sampler. Such personal dust samplers shall be of a type approved under Regulation 123 of the Coal Mines Regulations, 1957 and Regulation 124 of the Metalliferous Mines Regulations, 1961.

MMR 148

Standard of lighting in opencast metalliferous mines

In pursuance of Reg. 148(2) of MMR 1961, the standards of lighting to be provided during working hours at different places or areas where natural light is insufficient in opencast metalliferous mines have been specified vide Government Notification No. GSR-829, dated 18.6.1975, published in the Gazette of India dated 5.7.1975 part II Section 3(i).

The said Notification is reproduced below for guidance and strict compliance.

NOTIFICATION

Dhanbad the 18th June, 1975

G.S.R. 829-In exercise of the powers conferred on me as the Chief Inspector of Mines, under clause (b) of sub-regulation (2) of Reg. 148 of MMR 1961, I hereby specify, that where natural light is insufficient in opencast metalliferous mines, in the manner and at the level indicated in the Appendix.

Provided that where the undersigned is of the opinion that conditions obtaining at any mine are such as to render compliance with the standards specified in this notification not reasonably practicable or not necessary, he may by an order in writing exempt such mine from the compliance of this notification subject to such conditions as may be imposed in such order.

APPENDIX

Sl.No.	Place/Area to be illuminated	Manner in which it is to be illuminated	Minimum standard of the illumination (LUX)	Plane/Level in which the illumination to be provided
1	General working areas as determined by the Manager in writing	-	0.2	At the level of the surface to be illuminated
2	Work place of Heavy Machinery	So as to cover the depth and height through which the machinery operates	5.0 10.0	Horizontal Vertical
3	Area where drilling rig works	So as to illuminate the full height of the rig	10.0	Vertical
4	Area where Bulldozer or other tractor mounted machine works	-	10.0	At level of the crawler tracks
5	Places where manual work is done	To be provided at level of the surface on which such work is done	5.0 10.0	Horizontal Vertical
6	Places where loading unloading or transfer, loading of dumpers, trucks or train is carried on	-	3.0	Horizontal
7	Operator's cabins of	To be provided up to a	30.0	Horizontal

	machines or mechanisms	height of 0.8 metres from floor level		
8	At hand picking points along a conveyor belt	To be provided upto a distance of not less than 1.5 metres from the picker	50.0	On the surface the conveyor belt
9	Truck haulage roads	To be provided at level of the road	0.5 to 3.0	Horizontal
10	Rail haulage track in the pit	To be provided at level of the rail heads	0.5	Horizontal
11	Roadways and foot paths from bench to bench	-	3.0	Horizontal
12	Permanent paths for use of persons employed etc.	-	1.0	Horizontal

(Cir. Legis. 3/1976)

Provision of individual lights in opencast mines

The standards of lighting to be provided during working hours at different places or areas where natural light is insufficient in opencast mines have been specified vide circulars Legis. 1&3 of 1976.

The general lighting scheme of an opencast mine is generally connected to a common power source. During electric power failure which may occur at any time, the whole area becomes absolutely dark. At time such a situation may lead to occurrence of an accident. It is that individual lights may be provided at night to the workers in opencast workings. This will be in addition to the general lighting scheme.

(Cir. Tech. 13/1979)

MMR 153

Danger associated with use of ANFO in pyrite bearing ores

In the United States of America, Ammonium Nitrate-Fuel Oil (AN-FO) explosives were in use in an open pit copper mine where two non-fatal accidents occurred. It was thought that the accidents were caused by misfired charges of AN-FO, The ore from the vicinity of the accidents and the ingredients used to prepare the AN-FO charges onsite were examined. A thorough investigation into the matter revealed the following-

"Ammonium nitrate-fuel oil (AN-FO) mixtures are used as blasting agents in mining pyrite-bearing ores. The temperature of these ores can increase by the continuous, though at times slow, oxidation weathering of the pyrites. At elevated temperatures, AN-FO reacts exothermally with pyrite and the reaction becomes self-sustained at 120 +/- 10°C. The Bureau of Mines has conducted an investigation to determine the reactivity of mixtures of AN-FO with pyrite containing ferrous sulphate. The results of tests in a heated vessel simulating a hot borehole demonstrate that small amounts of ferrous sulphate, a major product of pyrite weathering, can initiate a self-sustained exothermic reaction with AN-FO at 80°C.

Five per cent by weight of urea was found sufficient to prevent a reaction among the three ingredients, at least within the limits of the test, which reached 180°C. Smaller amounts of urea

and of potassium oxalate slowed down the reaction and delayed its onset to higher temperatures, but did not prevent it."

For fuller details about the investigations, a reference may be made to U.S. Bureau of Mines Investigation Report No. R.I. 8373 of 1979.

In case the mining activities under your control fall within the parameters indicated above, you may take appropriate action.

(Cir. Tech. 4/1980)

Storage of explosive beyond its shelf life

It is understood that following the general shortage of explosives sometime last year, a number of magazines had built up large buffer stocks to tide over shortfall in supply. This has, however, resulted in a situation when old stock of explosive had been kept in storage beyond its shelf life in some places. This is, therefore, to caution you that old stock of explosive should not be used in the mine beyond its shelf life. Further you are advised to take immediate action to destroy such old stock in the manner given in circular 57 of 1964.

(Cir. Genl. 1/1981)

Safe destruction of blasting explosives

Instructions issued by the office of the Chief Inspector of Explosives for destruction of high and other explosives are reproduced below-

Instructions for destruction of blasting explosives

(1) **Gunpowder**-Gunpowder should be thrown into water preferably hot water which dissolves out the saltpetre and renders the explosive harmless. An alternative method is to lay it out in a train and fire this from one end by means of a piece of safety fuse; but if more than one train is laid, care should be taken to lay the second at such a distance from the site of the first as to run no risk of its being fired by the heated soil, as many serious accidents have occurred in this way.

(2) **Nitrate of Ammonium explosives**-These should be scattered on damp soil. These are so hygroscopic that even on a dry summer day a short exposure to the air renders them harmless, but it is generally easy to find a ditch damp enough to take immediate effect. If not generously applied these explosives make an excellent manure.

(3) **Nitro-compounds, gelignite, gelatine and other similar explosives**-Not more than 50 pounds of explosives should be destroyed at a time. A clear space of ground, about 100 yards all round should be selected. and a line of shavings or dry straw or grass laid down. On this the cartridges should be placed in a continuous line not more than two abreast with the cartridge wrappers and any other available paper below them. Paraffin or other similar oil, should then be poured over the shavings, straw or grass and cartridges for combustion. The line of shavings, straw or grass should be prolonged some distance beyond the explosives (say 20 ft.) and lit with a short length of safety fuse and the operator should then retire quickly to a safe distance.

The ground on which the destruction is to take place should be clear of dry grass and inflammable substances. The direction of the fire should be at about an angle of 45 degrees to the direction of the wind and the fire should be ignited from the weather end.

(4) **Dynamites**-Even in small cartridges and small quantities dynamites burn very easily to detonations. The degree of confinement caused by the cartridge wrappers is often sufficient to cause explosion. Dynamite should never be burnt in larger quantities than 5 lbs. at a time and the wrappers must be opened and unrolled. The site on which the destruction is to take place should be so chosen, and the fire initiated by means of safety fuse of such a length, that no risk is run by personnel or property in the event of the fire changing to explosion.

(5) **Safety fuse**-This should be destroyed by burning in lengths in the open under precautions.

(6) **Detonators**-Detonators should be disposed off by being taken to deep river, or to the sea, and then thrown into deep water by twos and threes, or they may be thoroughly soaked in mineral oil for 48 hours and then be destroyed one at a time, under suitable precautions, by burning.

(Cir. 57/1964)

MMR 162

Length of fuse outside the cartridge in fuse firing

The idea of specifying the minimum length is that the shot-firer/blaster gets adequate time to take shelter after he has lighted the fuse.

In certain cases long lengths of fuse are inserted into gun-powder cartridges with the result that the effective length of fuse outside the cartridges becomes much less than 1.2m. As a result, the shot-firer/blaster gets much less time to take shelter after he has lighted the fuse.

For the sake of safety of persons engaged on the dangerous occupation of handling explosives, it is necessary that not less than 1.2 m of fuse is kept outside a cartridge. .

(Cir. 45/1963)

Forcing down of explosives cartridges

Forcing a cartridge of explosive down a shothole. is always fraught with danger particularly when it is stuck up. Instruction exists in the Regulations not to charge when the shothole is of insufficient size [Reg. 168(9) of CMR 1957 and Reg. 162(9) MMR 1961].

It is equally dangerous when attempts are made to press or force a cartridge stuck up in a shothole of bigger size either due to some obstruction in the shothole or the cartridge having fallen diagonally. In drawing attention to the danger associated with such practice, it is required that at no stage should attempts be made to push any cartridge down when it gets stuck up either because of insufficient diameter, obstruction in the shot-hole or any other reason.

Such shot-hole should be dealt with in the manner laid down in the regulations for misfired shots.

(Cir. Tech. 1/1975)

Charging and firing of explosives in a crack, i.e. in an improperly drilled, charged and stemmed shot hole

Recently there had been an accident from a secondary blasting in an opencast mine. Enquiry revealed that about 62.5 kg of explosive was placed in a crack, measuring 7m by 4 m and 0.25 m in thickness without sufficient confinement in a toe of a dragline bench. The result was that a blasting projectile measuring 21 cm by 21 cm and 4 cm in thickness and weighing about 4.5 kg flew through a distance of 330m and hit a person who had taken shelter beneath a tree, inflicting fatal injuries to him.

Your attention is drawn to the provisions of Reg. 168(1), which require firing of shot in a properly drilled, charged and stemmed shothole and Reg. 170(1) of the CMR 1957 read with Cir. Tech. 8 of 1982 on taking proper shelter. Compliance of these mandatory provisions and circulars will go a long way in preventing such type of accidents.

[Cir. Tech 5/1999]

Accidents due to explosives

In recent accident in an opencast mine it was revealed that while two persons were charging shotholes with the help of an iron rod in close vicinity of other five persons who were engaged in drilling holes, explosive inside the shothole got exploded causing fire and explosion to uncharged explosive kept near the face. Flying fragments and burning materials caused by the explosion inflicted serious bodily injuries to all the seven persons two of whom succumbed to their injuries.

The extant regulations under CMR 1957 & MMR 1961 provide for the following:

(1) Before a shothole is charged stemmed or fired, the shotfirer/blaster is required to see that all the persons in the vicinity have taken proper shelter.

(2) In charging or stemming a shothole, no metallic tool/scrapper or is to be used.

In the instant case, the accident happened merely due to negligence and human failure. In spite of specific provision of law, persons in the vicinity were not removed before commencement of the charging operation and an iron rod was used for charging the shotholes, which resulted in loss of two precious lives and serious injuries to five persons.

All concerned are therefore advised to take utmost care during charging a shothole so that similar accidents do not recur. It is sincerely believed that management will spare no efforts to eliminate accidents due to above causes

(Cir. Tech. 7/2001)

MMR 164

Hours of blasting in opencast mines

It is dangerous to carry out blasting operations in opencast workings during the shift while other work is also being done in the area because under such circumstances it is difficult to ensure that all persons within the danger zone (i.e. 300m from the place of firing shots) have taken adequate shelter.

It is highly desirable that all blasting operations (including carrying of explosives into the working area, preparation of priming cartridges including soaking LOX cartridges, charging of shot holes, stemming of shotholes and firing) in opencast workings should be restricted to periods when the workings are generally clear of other work persons, i.e. the period between two consecutive shifts or at beginning or end of a working shift.

Where blasting is carried on in adjacent blocks or areas, minimum distance between such blocks should not be less than 300m.

(Cir. 11/1961)

Simultaneous blasting with fuse in opencast workings

It has been seen that, in many opencast mines a number of shotfirers/blasters are engaged side by side for simultaneous blasting operations. As shots fired by all such shot-firers/blasters are likely to go off together, it is difficult to count them for ascertaining whether there has been any misfire or not. If there is slight time stagger in blasting operations, some of the shotfirers/blasters may be injured by missiles thrown off by other blasting in the neighborhood, as they may not be able to take proper shelter in time. It is therefore advisable that, where a number of shotfirers/blasters are employed in proximity to each other (i.e., 300m on) one shotfirer/blaster at a time may fire shots and the interval between two shotfirer/blasters firing shots should not be less than 30 minutes.

(Cir. 1/1967)

Blasting in quarries beyond day-light hours

Precautions exist to prevent danger from projectiles due to blasting operations carried out in opencast workings within the danger zone of 300m. However when such operations are carried out beyond day-light hours, it may not be possible to ensure that all persons in the danger zone had taken shelter. There is also the possibility of some inadvertent entry into the danger zone by workers or even outsiders.

Therefore shots, if fired after day-light hours, should be muffled so that flying fragments from blasting cannot project beyond a distance of ten metres from the place of blasting. This may be noted for strict compliance in all blasting operations.

(Cir. Tech. 8/1976)

Danger from blasting operations in opencast workings

1. Under the extant regulations, before a shot is charged, stemmed, or fired, the shotfirer/blaster is required amongst other things, to ensure that all persons within a radius of 300m from the place of firing (referred to hereinafter as danger zone) have taken proper shelter, apart from giving sufficient warning by efficient signals or other means approved by the manager over the entire danger zone.

2. An analysis of fatalities which occurred in our mines during the last few years has revealed that nearly 6% of fatalities are associated with the use of explosives. And a large number of such fatalities are because of not taking proper shelter. What would constitute 'proper shelter' for the purposes of the aforesaid regulation is a moot point. However, for a proper appreciation of the causes of and circumstances attending such accidents, some typical accidents under different major cause groups are described below:

A. Accidents due to human failure

(i) Not posting guards at all points of entry into danger zone :

"While blasting was in progress in a limestone quarry, a non-employee entered the danger zone and was struck on the head by a flying piece of stone which was projected some 230m from the site of holes."

(ii) Not warning all concerned within the danger zone:

"while one manually drilled shot hole about 38cm deep was charged with gun powder and fired with safety fuse. a piece of stone measuring about 15 cm cube was projected over a distance of nearly 181m from the site of the shot hole, where it struck a worker of adjoining mine inflicting injuries which proved fatal on way to hospital."

(iii) Not taking shelter inspite of being warned:

"While seven shot holes each about 0.68m deep, were blasted in a stone quarry with the help of gun powder and safety fuse, a piece of stone from the site of shot holes was projected over a distance of nearly 145m, where it struck a new mine worker who was employed in an adjoining pit within the same mine and who had failed to take proper shelter inspite of being cautioned by the Blaster, killing him instantly."

(iv) Ignoring the warning and not muffling the shots:

"in a stone quarry 10 shot holes, each about 1.5m in depth, were fired in two rounds of 5 holes each. While the second round of 5 holes was fired with the help of special gelatine explosives and electric detonators, a piece of stone weighing about 2 kg was projected from the quarry to a distance of about 150m, where it struck a person who had just then come out of his house, inspite of warning signals given by the Blaster. Incidentally, although arrangements for muffling the shots were provided yet these were not utilized."

B. Accidents owing to failure of certain types of structures to provide adequate shelter within the danger zone

(i) "While 45 shot holes, 100 mm in dia. and about 2.7m in depth, charged with ANFO and special gelatine explosives were blasted with the help of millisecond delay action detonators in a bauxite

quarry, a number of laterite pieces weighing about 12-20 kg each, projected from the blast fell on the wooden rafter roof of a blasting shelter at a distance of nearly 17 metres.

After breaking the roof the laterite pieces struck the foreman and blaster, killing the foreman."

(ii) "In a stone quarry five shot holes each about 5 cm in dia. and charged with gun-powder were fired in one round with the help of safety fuse. A piece of stone weighing about 10 kg was projected from the quarry over a distance of about 60m and fell on tiled roof of a hut. It punctured the roof and hit one of the residents on the leg causing injuries."

(iii) "While 27 shot holes in coal, each 10 cm in dia., 5.4 to 6.0m deep, charged with 14 to 18 kg of explosives, were fired in one round, three pieces of coal, each weighting about 1 kg, flew over a distance of nearly 115m, fell on thatched roof of a tea stall and after piercing the same struck one person, inflicting serious injuries which proved fatal one hour later."

(iv) "Four holes, each about 5.4m deep, charged with 9/10 kg of ANFO and 2 cartridges of formablast, were fired with safety fuse. A projectile from the site of these holes travelled over a distance of nearly 300m and fell on asbestos roof of feeder canteen of the mine. The projectile pierced asbestos roof and struck a worker on the head, inflicting injuries, which proved fatal about 2 hours later."

(v) "In an iron-ore mine while 8 shot holes, each about 1.2 metres deep, were charged with special gelatine explosives and fired with safety fuse, a piece of iron ore weighing about 2.5 kg was projected over a distance of approximately 61m from the site of shot holes, hitting a tipping tub made of 6 mm thick steel sheet on its side causing a dent over an area of 24 cm x 16 cm. A worker who had taken shelter inside the tipping tub with his head resting against the spot struck by the projectile, received injuries on the skull which proved fatal instantly."

C. Accidents occurring beyond the stipulated danger zone

(i) "At the end of day's work while two rounds of shots, each comprising 10 small dia shallow holes, were fired with the help of special gelatine explosives, an employee of the contractor who was returning home and had reached a spot just outside the danger zone, was struck on the back of his head by a piece of stone causing instantaneous death."

(ii) "In a rock phosphate mine while 35 shot holes, each about 115 mm in dia, and 1,2m deep, were charged with 1200 kg of O.C. gelignite and ANFO and fired using delay action detonators, a piece of stone measuring 12 cm x 10 cm in size was projected over a distance of about 332m from the site of shot holes and after piercing asbestos cement sheet roof of a beneficiation plant under erection, struck a worker on the head inflicting injuries which proved fatal on way to hospital."

(iii) "While 19 shot holes, each about 1.5m deep and charged with one cartridge of SG explosive (80% strength) were fired in stone with the help of ordinary detonators and safety fuse, a piece of stone flew over a distance of about 365m and struck a railway wagon and after rebounding therefrom hit a loader who was loading the wagon in a railway siding, situated outside the leasehold of the mine, where blasting was done, causing serious bodily injuries,"

(iv) "While blasting was being done in an iron-ore quarry, an office-boy taking shelter at a distance of 460m from the site of blasting was hit by a flying fragment about 8 cm cube in size causing injuries which proved fatal shortly thereafter."

D. Some peculiar accidents

(i) "While deep hole blasting was done in overburden bench, a piece of stone measuring about 1m x 0.7m x 0.6m, instead of being projected away from the free face, flew in the opposite direction and landed on a mine tipping tub 58m away which was being used as shelter by the blaster. The tub was damaged causing fatal injury to the blaster."

(ii) "In a limestone mine while 34 large diameter holes varying in depth from 6 to 14m drilled on a pattern recommended by an Expert Organisation were charged with 177 kg of explosives, stemmed with sand, earth and stone dust and fired using delay action detonators, some pieces of stone from the quarry were projected to a distance of ,about 485 metres from the site of the holes hitting three persons causing injuries and also damaging tiles of houses in the village and window of the Church."

From the above it may appear that there is a case for revising the limit of danger zone from **300m to atleast 500m** and for prescribing that all those who must remain within the danger zone at the time of blasting, should take shelter in 'substantially built' shelters. Since it is difficult to define a 'substantially built shelter' which could be considered adequate for different types of blasting parameters, it would appear necessary that when the entire area of danger zone and a distance of atleast 200m beyond can not be got vacated, the shots should be fired by controlled blasting technique with milli second delay action detonators or be muffled in manner such that flying fragments cannot project beyond a distance of ten metres from the place of firing. In either case, the techniques of blasting and/or muffling should be got approved from the concerned Director of Mines safety.

(Cir. Tech. 8/1982)

MMR 170

Use of mobile phones and two way radio transmitters during charging of explosives and in filling stations

There can be substantial risk of premature firing of detonators and explosive from transmitted radio frequency (RF) energy and precautions are necessary against it. The common source of hazardous radio frequency (RF) transmission includes, *interalia*, *mobile citizen band* (CB) or side band radio transmitters, VHF (FM) radio transmission, VHF cellular telephones and radar transmitters. In our country cellular telephones are widely being used, including the mine sites. It has been observed that even during charging and preparation of explosives in opencast workings cellular telephones and two- way transmitters are used for communication. There is, therefore, risk of accidental firing of explosive with serious consequences. Similar type or risk exists while using cellular telephones and two-way transmitters in fuel oil filling stations in the mines. Therefore in the interest of safety, I request you to restrict the use of cellular phones and two-way transmitters while handling the explosives including preparing and charging of the same and in fuel filling stations in the mines under your control.

(Cir.Tech. 2/2005)

Damage of structures due to blast induced ground vibrations in the mining areas

1.Introduction :

In response to increase demand for coal and other minerals, a number of large mechanised opencast mines have come into operation. Some of these opencast workings are located near surface structure like residential buildings , schools, commercial shops. Hutments with large number of inhabitants etc. Whenever blasting is done in these opencast mines, ground vibrations are generated outward from the blast area and cause damage to surrounding surface structures. The vibrations radiating from the blast holes while passing through surface structures, induce vibrations on the structures causing resonance. The components of ground motion can affect the structures through compression and tension and also through vertical and horizontal shearing effects. Blast induced ground vibrations create socioeconomic problems for the mine managements as well as the people residing in vicinity of these mines. As only 20-30 % of energy of commercial explosives used in the mines is utilized for fragmenting the rock, the rest of energy is transmitted through the earth in the form of ground vibrations resulting in damage to the surrounding structures.

2.0 Damager Criteria

The peak particle velocity has so far been considered as the best criteria for evaluating blast vibrations in terms of its potential to cause damage. The extensive studies on the problems have

established that the frequency of the waves is also equally important factor to consider the effect of damage.

The blasting damage is generally classified into following four categories :

Sl. No.	Category	Description of damage
(i)	No appreciable damage.	No formation of noticeable cracks.
(ii)	Threshold damage	Formation of fine cracks, fall of plaster, opening & lengthening of old cracks, loosening of joints, dislodging of loose objects etc.
(iii)	Minor damage	Superficial not affecting the strength of structure(s). Hair line cracks in masonry around openings near partition, broken windows. Fall of loose mortar etc.
(iv)	Major damage	Formation of several large cracks, serious weakening of structures, shifting of foundation, fall of masonry, ruptures of opening vaults etc.

3.0 Natural Frequencies

Elements of building construction such as sprung floors, stud partition walls, ceiling and windows can all react as mass-spring systems, each with its own natural frequencies of about 4-24 Hz (low frequencies) Ground vibrations at these frequencies amplified by the structures increase the risk of damage. When the low frequency ground vibration coincides with the natural frequency of the structure resonance is originated. The resonance is a state in which the structure absorbs most energy progressively becoming deformed with time, until plastic deformation occurs. Therefore even the low peak particle velocity of ground vibrations at natural frequency of structure is more harmful to the structure. Natural frequencies of brick and concrete structure generally vary from 8-16 Hz.

4.0 Structural response

All structures develop cracks from natural causes like periodic changes in humidity, temperature and wind velocity. Changes in soil moisture cause foundation cracks. The width of old cracks change seasonally and number of cracks increase with the time. This damage is independent of damage caused by blasting. The cracking location and the wall material have an influence on the particle velocity at which cracking begins. If the entire structure is not inspected thoroughly, there may be chances of biased opinion on the type of cracks. Thus it is important to place transducer properly for the correct assessment of damage. In the mud houses, number of cracks develop before blasting and these cracks widened and extended with the passage of time. These cracks are further widened and get extended due to blast induced ground vibrations. Concrete structures vibrate for longer duration than brick and mud structures. Concrete walls have free top and show no cracks at vibration levels for which mud and brick walls can be damaged. Cracks develop in concrete walls with large vibration level. Cracks in brick-structures can be observed in junction of walls, roof and at window corners. Brick walls with clay mortar and cement- sand mortar behave in same fashion. Steel structures can sustain more vibration level. The magnitude of vibration on structures is much more than on the ground. Duration of vibration in structure is also longer than, that of ground vibration. Multi-storied buildings are more sensitive to blast vibration than single-storied buildings. To predict the extent of damage and to take preventive measures, it is necessary to measure ground vibrations due to blasting. Studies on structural response of ground vibration in the structures of different constructions within the mining areas under Indian conditions are limited and therefore such study should be carried out to ascertain the degree of damages for improvement and standardization of damage criteria under Indian conditions.

5.0 Measurement of blast induced vibrations

5.1 Instrumentation

The instrument selected for monitoring blast induced ground vibration shall be simple, light, compact, easily portable, battery operated, digital form output, triggering by geophone etc. Triaxial transducers for recording blast vibration shall have a liner frequency upto 500 Hz and capable of recording particle velocity upto 100 mm/s.

5.2 Methodology

The transducers shall be placed near the structure on the solid undisturbed ground and should be placed well in contact with the ground. For structural response, the transducers shall be placed horizontally over the wall, floors and ceiling. A minimum of 15 points of observations corresponding to a minimum of 10 blasts shall be made for better prediction with a high index of determination.

5.3 Predictor Equation

The least means square method of regression analysis shall be used to interpret the data. The square root scaled distance shall be used for analysis and interpretation of data when blasting is done on surface and measurements are taken on the surface, or the blasting is done underground and measurements are taken underground. On the other hand, if blasting is done on the surface and the measurements taken underground the cube root scaled distance shall be used.

6.0 Guidelines on experimental blasting

6.1 Factors

Major factors affecting particle velocity of ground vibration are type and amount of explosive charge used, distance from the charge to the point of observation (surface structures), geological, structural and physical properties of the rock that transmits the vibrations, height of structures and blast geometry. Use of safe charge/delay, in hole delay with non- electric initiation systems. Proper burden, inclined holes in conformity with slope of bench, deck charge, air deck, sequential blasting, clearing off loose pieces of rocks from the blast site and proper stemming of holes bring reduction in blast induced ground vibrations. Controlled blasting methods in conjunction with effective muffling of holes will control ground vibrations and also arrest fly rock.

6.2 Plan

A plan showing structures belonging to the to the owner and not belonging to the owner in different prominent shades should be prepared. The plan shall incorporate details of construction of the structures in a tabular form. Plan should also show 50 m., 100m, 200 m and 300 m zones from the structures, the place of experimental study and the limit upto the which blasting is proposed to continue.

6.3 Study/ observations

In a particular mining area with built-up structures where deep hole blasting is to be introduced for the first time, experimental blasting shall be carried out by any research/ academic institute much before the structures fall within the blasting danger zone. The type of instruments, the methodology and predictor norm as recommended in para 5.0 shall be followed in measurement of blast induced vibrations. Based on the study, the safe charges for different zones shall be determined and recommendations made in the report. In a cluster of buildings of different types existing close to each other, the charge for the buildings/ structures requiring greater protection against damage shall be assessed and recommended.

6.4 Structural response

During the study the response of the structures assuming different natural frequencies should be calculated and plotted on a figure. Softwares with the different programmes are available now for the said plot and should be used for convenience.

6.5 Monitoring

In order to ensure effective control over the vibration and related damages there is a need for regular inhouse monitoring and the managements should train the blasting personnel during the experimental study and start observations on their own during the regular blasting operations.

7.0 Recommended permissible standards of blast induced ground vibrations:

7.1 Technical considerations

Permissible standards for different type of structures have been arrived at considering the importance of building and structures. The buildings of historical importance and multi- storied structures are likely to get damaged with low level of vibration and therefore permissible standards are to be lowest. Similarly buildings not belonging to the owner but with mud/brick in cement construction and others with good construction (RCC and framed structures) should also be protected but higher permissible standards than that of the level fixed for first category has been

allowed. The buildings belonging to the owner of the mine are constructed for a limited period generally equal to the life of the project. The management accept that these buildings constructed within the mining area are likely to suffer some damages during the extraction of minerals, but the damages should be repairable. Therefore, slightly higher permissible levels of vibrations have been allowed in such cases.

7.2 Permissible standards

Depending on the type of structures and the dominant excitation, the peak particle velocity (ppv) on the ground adjacent to the structure shall not exceed the values given below in the table.

Table: Permissible Peak Particle Velocity (ppv) at the foundation level of structures in Mining Areas in mm/s

Type of structure	Dominant excitation Frequency, Hz		
	<8 Hz	8-25 Hz	>25 Hz
(A) Buildings/structures not belong to the owner			
(i) Domestic houses/structures (kuchha brick & cement)	5	10	15
(ii) Industrial Buildings (RCC & Framed structures)	10	20	25
(iii) Objects of historical importance & sensitive structures	2	5	10
(B) Buildings belonging to owner with limited span of life			
(i) Domestic houses/structures (kuchha, brick & cement)	10	15	25
(ii) Industrial buildings (RCC & framed structures)	15	25	50

In view of the complexities of the problems I hope you all would take adequate measures as recommended above to ensure that the blasts near surface structures are carried out with utmost care and precautions. The blast induced ground vibration should be within the permissible limits as specified above.

(Cir. Tech. 7/1997)

MMR 172

Precautions in use of grinding wheels

There have been cases of breakage of grinding wheels causing serious injuries to work-persons. The following precautions are laid down for adoption during their handling and use-

1. Grinding wheels shall be inspected carefully for any damage/crack etc. just before use.
2. Operating speed of wheel shall not be more than the maximum operating speed for which it is rated.
3. While mounting grinding wheel on the machine, care shall be taken to ensure that correct and clean mounting flanges and mounting blotters are used. Mounting hole of the wheel should not be altered and the correct tightening pressure be applied on the mounting nut.
4. Before starting the machine, it should be ensured that the 'Work Rest' is suitably adjusted, and the guard, covering one-half of the grinding wheel, is positioned.
5. While grinding, safety glasses or other type of eye protection should be constantly used by the operator and he should not jam the job into the wheel.
6. The job should not be ground at the side of the wheel; no material should be ground unless the wheel is designed for such purpose/material.
7. Whenever a grinder is started, the operator should not stand in front of the wheel and none should be normally present at the place of use of such grinders within reasonable unsafe area.

(Cir. Tech. 7/1979)

Precautions in tyre inflation

Recently in one of the mines there was a fatal accident in which a fitter helper died. While opening the shuttle car wheel underground, the tyre burst throwing out the locking ring with tremendous force causing the fatality. Further examination revealed that the wheel locking ring was indigenously developed and its sectional profile was not matching with the wheel rim groove. To avoid such accidents in future in underground mines or in opencast mines where heavy earth moving machineries are used, only suitable type and matching locking ring of correct size shall be used. Periodically the locking ring shall be examined for every tyre mounted vehicle for its suitability and a record of such examination shall be maintained. While fitting a new locking ring, it should be ensured that it fits correctly in the rim groove.

(Cir. Tech. 9/1979)

Accidents caused by compressed air due to use of sub-standard equipment, poor maintenance and defective installation

Investigations into a few serious and fatal accidents resulting from the use of compressed air equipment have revealed that substandard equipment. Defective installation and unsatisfactory maintenance were mainly responsible for the accidents.

The following safety measures should therefore be strictly followed where high pressure compressed air is used either aboveground or belowground in mines-

1. Air valves , pipes, bends and other fittings of compressed air system should conform to I.S.S. and should have I.S.I. marking where the I.S. has been formulated. Equipment conforming to A.P.I. can also be used. Certificates conforming to I.S. or A.P.I. should be obtained for every such part.
2. Compressed air distribution system should be provided with suitable valve at every branching off point. Where compressed air is conveyed below ground in the mine the main air line should be provided with suitable isolating valve in the underground so located that air supply to underground can be effectively and quickly stopped.
3. suitable water trap or drain cock should be provided before isolating valves and accumulated water in the trap should be properly drained before opening the isolating valve.
4. Suitable pressure should be provided on the outlet side of isolating valves to ensure proper functioning of the valve.
5. Hose pipe conveying high pressure air should be of reliable make, robust, of tested quality and antistatic type. The fittings of the hose pipes should be properly secured to prevent accidental disconnection.
6. The compressor should be properly maintained. Lubricating oil used in the compressor should be of a suitable type to minimize production of CO, and other harmful gases in the compressed air.
7. In underground coal faces or headings, after the compressed air range has been closed, the face or headings should be checked for presence of inflammable gas and the same, if present, should be satisfactorily cleared by ventilation before the high pressure air is admitted to any equipment.

(Cir. Tech. 4/1977)

Accidents from use of sub-standard or defective equipment and faulty practices in welding and cutting by oxy-acetylene gases

Investigations into a few serious accidents have revealed that either sub-standard equipment is used or necessary safety precautions are neglected while using oxy-acetylene gases or welding or cutting etc in the mines. The gases in the cylinders are generally under high pressure between

1.26 and 140 kg/cm² and very serious consequences can result from bursting of the high pressure equipment. It is, therefore, necessary that due regard to safety is given in the use of such equipment and oxy-acetylene gases.

The following instructions should be complied with in the use of oxy-acetylene welding and cutting-

1. Equipment of reliable manufacturer only should be used. The equipment should have I.S.I. certification mark.
2. It should be kept clean and in good condition so that it is safe. No oil or grease should be applied in the attachment of the regulator or the blow pipes.
3. Whenever gas cylinders are transported from one place to another, the regulator and other attachments should be disconnected and the cylinder caps should be put on to prevent any damage during transit. Gas cylinders should not be rolled on ground except when empty. They should be carried on proper rubber wheel trolley or similar means of transport.
4. While working with gas cylinders either for welding or cutting, adequate precautions should be taken against storage of inflammable material nearby Cotton waste soaked with oil or grease should not be kept in the vicinity where such work is carried on. Suitable lighters should be used for lighting the gas at the blow pipe instead of fire made from cotton waste or any other source.
5. Rubber hoses should be inspected periodically to see that they are not damaged by leaks, cuts, cracks etc., and can safely withstand the gas pressure.
6. Suitable fire extinguisher and sand should be readily available at the work site.
7. All oxy-acetylene welders should use goggles and hand-gloves. Lenses of the goggles should be of approved and standardised tint.
8. The gas blow pipe for welding or cutting should have in-built non-return valve.

(Cir.Tech. 6/1977)

Failure of drill rods

There have been cases of failure of drill rods thereby exposing the drillers on work to risk of accidents. Investigation into some of the cases has revealed that such breakages occur due to the following reasons presuming that the drill rod is of good quality and free from manufacturing defects-

Part A. (1) A loose chuck bushing of the drill machine.

(2) Unevenness and wear on the drill rod shank mating surface with the piston of drill machine.

(3) A loose clamp of drill machine holding the drill rod.

(4) Worn out tip of drill rod or blunt tip.

(5) Life of drill rod being over etc.

Part B. The following measures in this regard are suggested for immediate compliance-

No rod having lower tip dia. than the minimum specified should be used.

This measurement can be done after every grinding of tip by a template which manufacturers supply or can easily be made in a mine workshop.

(2) When the rod is worn out, it should be withdrawn from service. It can easily be seen in case of hexagonal rod which will look round when worn out

(3) Suitable timely checking of defects mentioned under items (1), (2) and (3) of part A above, during the course of repair and maintenance in repair shed should be undertaken. Spare drill machine should be made available so that properly checked and maintained drills replace the used drills in the face and thus undergo timely and regular checking/maintenance. Drill machines should be numbered and date of maintenance should be recorded.

(4) A pusher leg be used wherever practicable so that the operator can remain at a distance and weight of drill machine is supported on the same. This will provide safety to the operator in case of drill rod breakage.

(5) Normally life of a rod is indicated by the manufacturer in terms of metres drilled. If such figures are not available it can be established by the user by experience. Once life of a rod is over, it should be withdrawn from service.

(6) Painting of the central hole which carries water for purifying by suitable chemical so as to prevent rusting, pitting etc. Time to time cleaning of the hole by scale removing compound can be undertaken if necessary.

(Cir.Tech. 5/1978)

Audit/inspection of equipment on hire/contract

Investigation into a number of accidents connected with equipment/machinery involving equipment on hire/under contract have revealed that, sub-standard equipment and unsatisfactory maintenance were mainly responsible for the accidents. Recently a fatal accident took place in an oil mine when the crane super structure fell off its turn-table during the operation. The enquiry has revealed that the crane belonged to a contractor and there was no system for audit for such equipment though system of auditing exists in the mine for departmental machinery/equipment. In this connection your attention is once again invited to the Cir. Tech. 36 of 1972, Tech. 3 of 1981, Tech. 2 of 1986 and Tech. 1 of 1989 which cover the requirements of proper care, maintenance and examination of equipment. It is further to say that apart from the measures suggested in the circulars, the following procedure be adopted to avoid recurrence of such accidents:

(i) All contractual/hired machinery engaged in the mine shall be audited/inspected by a team consisting of mine officials and contractor's technical personnel for their suitability before engaging in the mine.

(ii) The contractor's equipments are also to be checked by a competent person of the mine periodically.

(Cir. Tech. 1/1999)

Safe use of mobile cranes: code of practice

A large number of mobile cranes are being used for material handling purposes in most of the mine premises. A few fatal and serious accidents have been reported due to unsafe use of such mobile cranes.

In view of the above, a code of practice for safe use of mobile cranes has been framed based on BIS 4573 of 1982 and BIS 13367 (Part I) of 1992.

The code of practice is as follows:-

1. Crane Safety Equipment to be Provided with the Crane

1.1 Automatic Safe load Indicator-An automatic safe load indicator shall be provided to give warning of an approach to the safe working load and a further warning when an overload occurs.

1.2. Load Radius indicator-A load radius indicator shall be provided which shall be clearly visible to the driver and indicate the appropriate safe working load and radius for whatever configuration the crane is used.

1.3 Motion Limit Devices/Overload Cut Out Devices- motion limit devices shall be provided to limit hoisting, derricking, slewing, and boom extending or any other crane motion in case of overload or unsafe operation.

1.4 Audio Visual Alarm during reversing -Effective Audio Visual Alarm shall be provided to be actuated automatically whenever the crane is being reversed.

1.5 Machinery Guarding - Effective guards shall be provided for gear wheels, chain drives and revolving shafts, couplings, collars and set screws or similar moving parts, unless those parts are made safe by design or by position or are effectively guarded by parts of the crane structure.

1.6 Design Parameters of the mobile crane-All parameters should meet the specifications for power driven mobile crane HIS 4573 of 1982.

1.7 Shackles and slings must conform to the relevant Indian Standard. Certificates of the shackles and slings shall be maintained along with the other crane records followed by periodical inspection.

2.0 Appointing various Competent Persons

2.1 Supervisor- The supervisor must be trained and experienced to plan the total lifting-operation safely. He shall ensure that there is an effective procedure for reporting defects and incidents and that adequate maintenance of the equipment is carried out.

He shall be given authority to stop the operation of the crane whenever he considers that danger is likely to arise should the operation continue. He shall ensure that the crane is not operated in overloading situation.

2.2 Crane Driver-The crane driver shall be responsible for correct Operation of the crane in accordance with the manufacturer's instruction book and the plan. The crane driver shall at any time only respond to the signals from one slinger/signaller who should be clearly identified. He shall ensure that the crane is not operated in overloading situation.

2.3 Slinger-The slinger is responsible for attaching and detaching the load to and from the crane hook and the use of correct lifting gear and equipment in accordance with planning of the operation. The slinger shall be knowledgeable enough to use the proper sling at the proper place of the load to be lifted.

2.4 Signaller- The signaller shall be responsible for relaying the signal from the slinger to the crane driver. The signaller may be given the responsibility for directing movement of the crane and load instead of the slinger provided that only one person has the responsibility. The signaller must understand the signal code.

3.0 Personal Safety Equipment

All competent persons shall use safety gloves, helmet, safety spectacle, ear defenders during appropriate operation.

4.0 Access and Emergency escape

Safe means of access and emergency escape shall be provided and maintained in good condition-

4.1 For the driving position.

4.2 For Inspection, maintenance, repair, erection and dismantling of crane.

5.0 Boarding the Crane

No person shall be permitted to board a crane without first obtaining the driver's agreement.

6.0 Fire Extinguishers

These shall be provided in all the cabins of the crane. They shall be periodically inspected and renewed as necessary.

7.0 Record keeping

7.1 Records shall be maintained for each crane that are sufficient to enable the condition of the crane to be determined and its fitness for further operation to be properly assessed.

7.2 Records shall also include technical information including maintenance instructions and performance data provided by the manufacturer.

7.3 Records of test certificates and all inspections of ropes and brakes shall be maintained. All significant repairs shall also be recorded.

8.0 Proximity Hazards

Consideration shall be given to the presence of overhead electric line or conductors, oil/gas/steam pipe lines, nearby structure etc. Where any part of the crane or its load cannot be kept clear of such hazard, the appropriate authority should be consulted.

9.0 Periodic Checks

Supervisor must ensure that all daily, weekly and monthly checks as recommended by the crane manufacturer are carried out and proper records be maintained.

10.0 Other pre-requisites of the mobile crane

10.1 Different configuration of operation like ' On TYRE', 'On OUTRIGGER' shall be mentioned in the crane.

10.2 Load lifting capacity chart for different configurations like, on 'TYRE', on 'OUTRIGGER', maximum rope tension etc. shall be available with the crane. Load lifting capacity on TYRE shall actually be much less compared to the load lifting capacity on OUTRIGGER as can be seen from the literature/load charts supplied by the crane manufacturer.

11.0 Stability

11.1 Condition of tipping-The crane is considered to be at the point or tipping when balance is reached between the overturning moment of the load and the stabilising moment of the machine at which point addition of any further load will cause imbalance.

11.2 To avoid toppling of crane, the operator should select correct configuration prior to the operation of the crane like telescoping of boom, slewing of super structures, derricking of boom, lifting of load etc.

12.0 Pick and Carry operation

Normally mobile crane should not be used as a transport equipment. However, where pick and carry operation by the manufacturer of the crane has been permitted. the crane driver shall not exceed the maximum recommended load for pick and carry and he shall keep the load either at over front or over rear as mentioned in the crane configuration and lock the slewing operation. Minimum ground clearances. shall be maintained in such cases so that the carrying load may be guided/supported. The travelling speed of the crane during pick and carry shall be as minimum as possible (within 1 km to 4 km per hour) or as recommended during such operation by the manufacturer.

13.0 Training

The competent persons must obtain training for operation and safety in the use of crane in consultation with the crane manufacturer.

Henceforth, the above guidelines may be strictly followed for the use of mobile cranes in mines in the interest of safety.

(Cir. Tech. 10/2002)

Providing flash back arrestors in gas welding/cutting sets

Investigation into a few serious accidents revealed that while using gas welding, set to cut angles or other material, there had been incidence of back fire which, caused burn injuries to the welders. When a back fire occurs, the products on explosion will normally go back to the point where gases of the system get mixed. The explosion generates sufficient heat to explode the forward owing gases. The phenomena happens very rapidly and can be detected by a sharp bang followed by a high pitched scream or whistle. Black smoke can be often seen emitting from the nozzle. Flash back is actually a back fire where so much energy can be generated that the explosion is forced back along one of the hoses and can even burst it. Then there is the risk of explosion passing through the regulator to cylinders with a possibility of an accident with even fatal consequence.

In some welding sets a non return valve had been provided as a safe-guard, however, provision of non-return valves will only ensure that the gases cannot back feed into the system but will not stop the force generated by a flash-back once it has occurred and danger due to explosion cannot be eliminated.

It is therefore recommended that flash back arrestor be provided in gas welding set on the oxygen and fuel gas lines, as well as nozzle side.

ISO 5175 of 1987 (E) has dealt with "Equipment used in gas welding, cutting and allied processes-safety devices for fuel gases and oxygen or compressed air-General specifications, requirements and tests."

It is necessary that the flash back arrestors so provided should conform to ISO 5175 of 1987(E) (or the latest version as and when published) in all respects. Such flash back arrestors shall be provided with non return valve, flame arrestor, pressure relief valve, temperature sensitive cut off valve, pressure sensitive cut off valve and excess flow cut off valve.

The above recommendation may be complied with in all gas welding and cutting processes in the interest. of safety.

(Cir. Tech. 12/2002)

Proper layout of workshop located in the precincts of opencast mines

Enquiry into some of the fatal accidents which had occurred in the precincts of workshop of opencast mines in the recent past has revealed that there was lack of proper parking place for dumpers and other heavy earth moving machineries (HEMM) leading to haphazard parking. Further, canteen, time office, bi-cycle and other two wheeler sheds, site officers, stores etc. were so located that employees and visitors had to regularly use the area frequented by HEMM. All these observations bring to focus the need for proper layout of workshops.

The 7th conference on Safety in Mines has also recommended that adequate attention should be given towards proper layout of repair sheds and workshop to ensure due protection to work persons employed at these places from the movement of heavy earth moving machineries. Each company should ensure that for every mine a scheme is drawn and implemented for proper maintenance, repair, overhaul and erection in respect of HEMM. This scheme should cover places such as sheds and workshops. Every help if required should be obtained from manufactures also.

In order to prevent recurrence of such accidents, besides implementing the relevant recommendation of the Conference on Safety in Mines, following additional steps may be taken in respect of layout of workshop :-

- 1 The path of movement of HEMM and that of other light vehicles shall be completely separate.
- 2 Canteen, time office, site officers, stores, two wheeler shed etc. shall be located where the movement of HEMM is the least.
- 3 Minimum number of persons are required to pass through workshop area.
- 4 Proper parking area for HEMM and earmarked paths for their movement shall be provided.
- 5 Exclusive brake testing area properly demarcated and protected by substantial fencing shall be provided in the precincts of the workshop where the operators may test the brakes of the HEMM as and when required.

The above recommendations shall be implemented strictly in the interest of safety.

(Cir. Tech. 8/2003)

MMR 173

Testing and examination of apparatus under pressure

The provisions of Reg. 183(3) of CMR 1957, Reg.- 173(3) of MMR 1961 and Reg. 78(3) of Oil Mines Regulations 1984 require that when apparatus under pressure is put into commission, the engineer or other competent person shall subject it to a hydraulic test at a pressure atleast one and half times the maximum permissible working pressure. It is also required under the same regulation, that a similar test shall be made after every renewal or repair and in any case at intervals of not more than three years. The result of such tests is required to be recorded in a bound-paged book kept for the purpose and be signed and dated by the person carrying out the test.

In the recent past a few dangerous occurrences due to bursting of compressed air tanks have taken place prior to completion of three years. It seems that at the time of hydraulic test the

internal condition of the tank vis-à-vis wall thickness was not inspected/assessed and the permissible safe working pressure in the tank was not calculated keeping all factors in mind. In view of the above, it is recommended that henceforth whenever hydraulic test is done as required under the law, assessment of the safe working pressure shall also be done based on residual thickness, pitting and corrosion of the wall of such pressure vessels. The present thickness of wall, seam etc. shall be compared with original thickness and a decision to repair/replace the receiver shall be taken. Where it is not possible to measure the thickness of the wall physically, use of ultrasonic thickness gauge is recommended. The report of the result of every test/examination shall be maintained as per proforma given below:

REPORT OF EXAMINATION

1. Name of the Mine:
 2. Name, description and distinct number of pressure vessel:
 3. Name and address of the manufacturer of the air vessel:
 4. Particulars of vessel-
 - (a) Date of construction:
 - (b) Thickness of wall:
 - (c) Date on which the vessel was taken first to use:
 - (d) Safe working pressure recommended by manufacturer:
 5. Date of last hydraulic test (if any) and pressure applied:
 6. Is the vessel exposed to weather:
 7. What examination and test were made:
 - (a) Hydraulic testing (pressure applied and duration)
 - (b) NDT testing (minimum thickness in wall, seam) :
 - (c) Condition of vessel for further use (permissible safe working pressure as calculated) :
 8. Date of examination:
 9. Repair required and period within which it should be executed :
 10. Other observations:
- State the condition of fittings and appliances provided in the vessel.
11. Mention the type of Ultrasonic Thickness Gauge used:
 12. Remarks:

Signature of the Competent Person
carrying out the Test & Examination
Name:
Qualification:
Date:

The above recommendation shall be followed strictly in the interest of safety.

(Cir. Tech. 7/2003)

MMR 177

Fencing

To obviate unnecessary reference in this respect, it is desirable that a standard procedure is followed in constructing fences for various purposes, Appendix I gives details of different types of fences, while Appendix II gives the situations in which the different types of fences should be used. Fences provided in mines should generally conform to those requirements.

APPENDIX I

Types of Fences

Type	Particulars of construction of fence
S1	0.40 metre thick brick wall in lime mortar not less than 1.20 metres high with a barbed wire fence not less than 0.60 metre high (with wires not more than 0.25 metre apart) on top.
S2	0.40 metre thick brick wall in lime mortar not less than 1.50 metres high with a parapet top or 0.75 metre thick stone wall in lime mortar not less than 1.50 metres high.
S3	Wire ropes, wire rope strands or barbed wire supported by movable post-stands (wooden, iron or concrete), the gap between adjacent members being not less than 0.30 metre and the bottom-most member not more than 0.25 metre and the top-most member not less than 1.00 metre from ground level.
G1	Rigid steel fencing, vertical members being not more than 3.0 metres apart and the gap between adjacent horizontal members not more than 0.25 metre, the bottom-most member being not more than 0.15 metre and the top-most member not less than 1.0 metre from ground level. The vertical members of the fencing should consist of girders, channels or angle irons not less than 5 x 5 cm in cross-section or rails not less than 10 kg weight per metre, steel pipes not less than 7.6cm in diameter; or reinforced concrete posts not less than 15 x 15 cm section. The horizontal members of the fencing should consist of expanded metal sheets with holes not greater than 10 cm size, of steel pipes not less than 2.5 cm diameter, of solid rods not less than 2 cm diameter, of strap iron not less than 2.5 : 0.6cm in size.
G2	Barbed wire fencing, with specifications similar to G 1 except that the horizontal member should consist of barbed wire.
G3	0.50 metre thick stone wall in lime mortar not less than one metre high. Wire ropes with pillars, vertical members being not more than 3.0 metres apart, and the gap between adjacent horizontal members not more than 0.25 metre, the bottom-most member being not more than 0.15 metre and the top-most member not less than one metre from ground level. The vertical members of the fencing should consist of props not less than 13cm in diameter, of iron pipes not less than 10cm in dia; of girders not less than 5 x 5cm or rails not less than 10kg weight per metre; of concrete pillars; or of brick or stone in lime mortar. The horizontal members of the fencing should consist of wire ropes or wire rope strands of barbed wire.
G4	Rigid wooden fencing, vertical members being not more than 1.50 metres apart; and the gap between adjacent horizontal members not more than 0.25 metre, the bottom-most member being not more than 0.15 metre and the top-most member not less than one metre from ground level, The vertical members should not be less than 5cm in diameter,
G5	Metallic guards of sheet metal or of wire mesh or of expanded metal,
U1	Wire ropes, wire rope strands or barbed wire or wooden rolls nailed or fitted on vertical props set flush on the sides of the gallery and also in the middle of the gallery if necessary; the gap between the adjacent members being not more than 0.30 metre, and bottom-most member should not be more than 0.25 metre and the top-most member not less than one metre from ground level.
U2	Two wire ropes, wire rope strands, barbed wire or wooden rolls fixed (preferably with cement or lime mortar) in the sides of the pillars across the gallery, at a height of about 0.60 and 1.0 metre respectively.

APPENDIX II
Uses of various types or Fences

	Situation	Type of fencing to be used
1	storage tanks for water to be used in any operation connected with mining	S1 with suitable gate (with locking arrangements) for authorized entry.
2	Top of abandoned shafts or inclines	S2
3	Top of working inclines	S2
4	Top of storage bunkers for sand etc.	S1, S2 or G2
5	(a) Top of abandoned Quarries and subsided areas and tramlines if lying with 30 m of residential building etc. (b) Top of other abandoned quarries	S1 or S2 S2 or G1 if fencing is within 5 metres from edge and G3 or G4 if the fencing is at a distance greater than 5 metres from the edge
6	Subsided surface. Surface likely to subside; surface above underground fire etc.	Natural growth of thorny bushes may also be used for the purpose.
7	Top of working quarry (a) moving fronts (b) others	S3 or G2 As in situation 5 above
8	Tops of underground staple pits. sumps and insets and mid-landing in shaft	S2 or G1
9	Open tops of drifts	S2 , G1 or G4
10	Top of working shaft	G1
11	Moving & dangerous parts of machinery	G1 or G5
12	Tramline bridges and gantries	G2
13	Moving shafts. couplings and gears of machinery	G3 or G5
14	Entrance to the site of an accident or to a place where inflammable or noxious Gas has been found , or where there is some other danger and the danger has not yet been removed	U1
15	Entrance to goaves	U1 to be provided outbye the first support at the goaf edge.
16	Disused galleries	U2

(Cir.11/1959)

Accidents in discontinued/abandoned workings

Every year some unauthorized persons or villagers get involved in accidents while surreptitiously working in an abandoned/discontinued mine. They have occasionally to pay the supreme price of such a folly with their lives or get maimed for life, but this does not in any way absolve a mine management from discharging its obligations under law to keep the entrances to all such workings adequately fenced or blocked off.

Recently a fatal accident occurred in a mine when 6 villagers went to an abandoned quarry to cut coal surreptitiously. A mass of overburden about 4.2 m x 3.6 m fell from a height of about 3.6 m killing one of them (a boy of 12 years) on the spot and injuring 3 others. Such instances occur every now and then, be it a coal mine or a metalliferous mine.

This is therefore, to remind to get the fencings of all such places Checked up and put them in order wherever there be any deficiency. Suitable steps should also be taken to ensure that the fencing remains intact and secure.

(Cir. 22/1974)

MMR 181

Preventing entry of children in mine premises and fencing of abandoned installations

While four boys were taking shelter underneath an abandoned haulage foundation, the foundation collapsed injuring all- one of them succumbed to his injuries in the hospital.

Entry of persons below 18 years of age in any part of the mine is prohibited under section 45 of the Mines Act 1952.

It is therefore recommended that:

- (i) any part of the equipment or installation not being used for mining purpose currently shall be totally dismantled, or properly, adequately and duly fenced off effectively. If any covering is to be done, it should be done in a permanent safe way;
- (ii) mine management should ensure that children do not enter the mine premises/workings (current or abandoned) so as to endanger their lives.

(Cir. Tech. 1/1997)

Precautions while reversing vehicles

Several accidents have occurred in mines while reversing vehicles. The code of precautions for truck transport (Cir. 11/1973) prescribes that where the view is not clear, the driver should take assistance of a spotter for operating the vehicle in the reverse direction. He is also required to give audible warning signal before reversing.

A separate horn with a sound different from the normal horn of the vehicle should be provided for this purpose. Driver should continue blowing this horn during the process of reversing the vehicle. Such horn should be standardized in a mine so that whenever a horn having the particular sound is given, it would become evident that the vehicle is being reversed. In some countries manufacturers have provided such horns which operate automatically when the vehicle is reversed. Possibility of incorporating such arrangement should be explored.

In addition to a separate horn; flasher lamp at the rear end of the vehicle, in series with the dial light on the control panel should be provided.

(Cir. Tech. 7/1977)

Protection of workers against Noise and Vibration in the working environment

Unlike other major countries practically no work has been done in Indian mines so far to study the hazards of noise and vibration in the working environment. There can, however, be no doubt that we have to tackle this problem with the increasing mechanization of mining operations. Probably, this, Problem already exists in the following situations, amongst others-

- (1) while operating pneumatic drills etc.
- (2) near heavy earth moving machinery ,
- (3) in locations housing continuously operated machinery like surface mechanical ventilator, surface screening plants, underground main pumps etc.
- (4) during operation of Anderton Shearer machine etc.

2.1 It is known that exposure to noise may interfere with speech , communication, cause annoyance and distraction. It may also reduce output and efficiency and cause fatigue apart from various health disorders unrelated to the effects on the hearing.

2.2.1 It is often asserted that noise reduces output and efficiency and affects morale. A change in noise level, up or down, from those to which persons are accustomed may cause adverse effects which quickly subside. It is difficult to demonstrate any prolonged effect on performance or working efficiency but in as much as sound can cause annoyance, difficulty in communication etc. this may become a factor for absenteeism etc,

2.2.2 Fatigue may result from having to talk loudly or from extra effort caused by misunderstanding—a matter difficult to assess objectively. It has been claimed that many noisy occupations cause 'nervous irritability and strain' but the reaction varies greatly in different individuals.

2.2.3 In certain circumstances, noise may cause a decreased electrical resistance in the skin, reduction of gastric activity, or increased muscle tension.

2.2.4 All the above consequences are leading to even fatal/serious accidents in mines.

3.1 It is felt that a time has come when some noise limits should be indicated as a goal to be achieved, the main objectives in this regard being:

- (a) to prevent a risk of hearing impairment;
- (b) to prevent interference of communication essential for safety; and
- (c) to eliminate nervous fatigue with due consideration to the work to be done.

Recommended Noise Standards-3.2 Based on the recent ILO Code of practice the following standards and guidelines are provisionally recommended for attainment. as far as practicable:

3.2.1 A **warning limit value** of 85 dB(A) may be set as the level below which very little risk to an unprotected ear, of hearing impairment exists for an eight hour exposure.

3.2.2 **The danger limit value shall be 90 dB(A)**, above which the danger of hearing impairment and deafness may result from an unprotected ear:

provided that during emergencies, or because of unforeseen technical reasons, a worker may be temporarily authorized to exceed the daily dose, but only if on the next day he recuperates so that the maximum weekly dose does not exceed the value specified above.

3.2.3 A worker should not be allowed to enter, without appropriate ear protection, in area in which the noise level is 115 dB(A) or more.

3.2.4. Personal protective equipment shall be worn, if there are single isolated outbursts of noise which can go above **130 dB(A) impulse** or **120 dB(A) 'Fast'**.

3.2.5 No worker shall be allowed to enter an area where the noise level exceeds **140 dB(A)**.

Identification and marking of Risk Areas-4.1 In order to identify risk areas, noise levels should be measured where:

- (a) an inspection discloses that such risk may exist;
- (b) the workers complain that they are subject to an uncomfortable or disturbing level of noise; or
- (c) speech intelligibility is impaired (in a normal voice) at a distance of 50cm or less.

4.2 Marking of the following risk areas and equipment should be done so as to :

- (a) indicate clearly equipment producing noise in excess of 85 dB(A);
- (b) display prominently a suitable sign forbidding entry to all except those wearing appropriate means of protection.

Measurement of Noise Level-5.1 Noise should be measured whenever speech intelligibility is impaired (in a normal voice) at a distance of 50 cm or less. Measurement of noise may be made in one of the following ways:

- (a) at the level of the worker's head in his ordinary working posture; or
- (b) with the microphone at 1 metre away from the worker's head in this position, and on both sides. Should the figures obtained vary from one place to another, the highest value ought to be taken.

5.2 The persons responsible for monitoring noise and vibration in the working environment should have received appropriate training in the measurement and control of noise and vibration. They should be equipped with suitable instruments to do the job.

5.3 It is no doubt important to ascertain whether the technical preventive measures remain effective. For this purpose, there should be periodical inspections and checks of the risk areas and equipment. For this purpose, a systematic programme of assessment of noise levels should be undertaken.

Protective measures and technical control-6.1 Use of the following protective equipment. may be considered, in appropriate cases:

- (a) ear-plugs, which can be used more than once;
- (b) disposable ear-plugs (ear-plugs made of ordinary cotton wool are prohibited);
- (c) ear-muffs; and
- (d) helmets and other specialized ear-protectors.

6.2 Needless to say, personal hearing protection should on no account be in lieu of technical prevention. Appropriate measures to prevent generation, transmission, amplification, and reverberation of noise and vibration should therefore be taken when machinery and equipment is being designed. Noise and vibration levels should also be amongst the factors to be taken into account when any machinery or equipment is to be ordered. Accordingly, there should be a close liaison with manufacturers with a view to reducing noise and vibration emission of such machines and equipment. Obviously, it is preferable to purchase quieter equipment, or which produces less vibration than to be compelled later on to take steps against excessive noise and vibration.

6.3 When neither by suitable design of equipment nor by their installation noise and vibration levels can be brought below the danger limits, the following protective measures may be considered:

- (a) enabling workers to have easy access to soundproof booths either totally or partially enclosed;
- (b) providing workers with adequate hearing protection and anti-vibration devices;
- (c) providing workers with anti-vibration working platforms; or
- (d) limiting time of exposure to excessive noise or vibration.

Vibration Limits-7.1 As for the vibration limits, aim should be to take appropriate steps which will ensure desirable degree of comfort and protection required specially against:

- (a) vibrations affecting the hands and arms (vibrating tools); and
- (b) whole body vibration transmitted through the supporting surface.

7.2 No specific vibration limits are indicated because available scientific data is inadequate. However, for a continuous exposure maximum permissible levels of vibration, depending on daily exposure, should be laid down, in the light of current scientific knowledge, technical progress, and possibilities of prevention.

Action-8.1 I shall be pleased if suitable steps are taken by you to reduce, by all appropriate means, the exposure of workers to any excessive noise and vibration. The Directorate may please be kept informed of action taken in this regard.

(Cir. Tech. 18/1975)

Protection of workers against noise

Based on the ILO Code of Practice certain standards and guidelines were provisionally recommended vide Cir. Tech. 18 of 1975 for protection of workers against noise.

2.0 Recent surveys in some mines have shown that operators of pneumatic jack hammer drills, rock breakers, rocker shovels, mechanical loaders, shovels, draglines and other heavy earth moving machines and other persons working in the vicinity thereof are getting exposed to sound levels higher than those recommended in the above circular.

The surveys indicated the following noise levels near different machinery:

2.1 In an underground metalliferous mine,

- (i) jack hammer drills -106 dB(A)
- (ii) rock breaker -106 dB(A)
- (iii) rocker shovel -104 dB(A)

2.2 In an underground coal mine,

- (i) near shearer -96 dB(A)
- (ii) transfer point -99 dB(A)
- (iii) tail end of belt conveyors -89 dB(A)
- (iv) power pack of pump -91 dB(A) .

(v) drive head of AFC -96 dB(A)

2.3 In an opencast mine,

(i) near drill -111 dB(A)

(ii) in dumper cabin while moving -103 dB(A)

(iii) diesel shovel (in cabin) -89 dB(A)

3.0 Such high noise levels are likely to affect not only the safety of 'Persons exposed to noise but also their productivity. It is, therefore, recommended that immediate steps be taken to control noise level and afford necessary protection to workers against noise. Given below are some suggestions for noise control and ear protection:

3.1 Noise exposure is the product of the noise level and the exposure duration and hence may be controlled by reducing either. However limiting noise level reaching the ear by noise reduction at the source is by far the most cost effective and positive approach whereas reduction of exposure duration, the common administrative action of personnel rotation to spread the exposure amongst several workers should be resorted to in special situations only when noise control is impractical or not feasible.

3.1.1 The first method of noise control is to plan work areas, so that employees and noise sources are kept as far apart as is practicable.

3.1.2 Control can be also affected at the source by engineering design of the machine or equipment and its proper installation and maintenance e.g. damping impact noise, noise insulation by sound absorbing materials, acoustic barriers or enclosures etc.

3.2 In situations where noise control at source is just not possible and purely as a temporary measure while engineering work is being undertaken, personal ear-protection should be used.

3.2.1 The actual ear protection is a function of construction of the defender, frequency of noise and the fit of the device to the subject and differs widely with different manufacturers. Attenuation quoted by the suppliers is the average of change in hearing threshold obtained on a number of subjects when the protector is correctly fitted. The assumed protection is also frequency dependent-typically the attenuation provided goes from little or nothing at low frequency upto 35 to 40 dB(A) at high frequency.

3.2.2 The normal range of hearing of a healthy young person extends from approximately 20 Hz. To 20 KHz. human ear is most sensitive to sound between 2 kHz and 5 kHz and less sensitive at higher and lower frequency.

In terms of sound pressure level (SPL) audible sound ranges from the threshold of hearing at 0 dB (A) to the threshold of pain which can be over 130 dB(A).

3.2.3 It is necessary to consider design of protection against the frequency spectrum of the noise in question in order to calculate dB(A) level inside the ear canal. Since protection is afforded only if the defender is worn properly, it is advisable to choose a device with lower performance if its comfort factor is significantly better than the heavy duty type.

On the basis of acoustic measurement, different types of hearing protectors can be placed in one of the following categories of protection-

Low-	for noise level	85 -100 dB(A)
Medium	-do-	100 -110 dB(A)
High	-do-	110 -120 dB(A)
Extra High	-do-	above -120 dB(A)

3.2.4 A list of different types of hearing defenders in use in British coal mines is given in the Appendix.

4.0 Effective personal hearing protection programme essentially comprises of the following constituents-

(i) assessment of noise exposure level,

(ii) determination of level of residual protection after implementation of reasonably practicable noise control measures,

(iii) selection of protectors to give the required attention,

(iv) workers' perception of the consequences of not wearing protector correctly,

- (v) selection of protector acceptable to the individual worker for the period of required use,
- (vi) selection of mutually compatible item of other personal protective equipment required,
- (vii) training of wearers to ensure that they know how, where and when protectors should be fitted,
- (viii) demarcation of the work locations where protector should be worn,
- (ix) adequate supervision to ensure protectors are worn correctly, when and where required,
- (x) maintenance of protector in an efficient and hygienic condition.

5.0 Early steps may please be taken-

(i) to reduce, by the appropriate means, the exposure of workers to any excessive noise, and

(ii) to procure suitable sound level meters and conduct noise level surveys in the manner recommended in Cir. Tech. 18 of 1975.

Appendix

HEARING PROTECTORS-APPLICATION

Level of protection: Low: L -for noise levels 85-100 dB(A)

Medium: M -for noise levels 100-110 dB(A)

High: H -for noise levels 110-120 dB(A)

Extra High: X -for noise levels above 120 dB(A)

Protection Type	Protection level	Possible application	Typical Reduction dB(A)
(a) Earmuffs			From to
<u>Air stream Helmet</u>			
<u>Mounted</u>	M	Dint header operator	95-70
Recal quick snap			
<u>Helmet mounted</u>	L	Road header operator	97-85
Super C	L	Road header operator	97-84
Belcap L	M	Working near auxiliary fan	115-85
Recal quick snap	H	Airleg borer operator	118-89
Silenta Super			
<u>Special helmet mounted</u>	L	Semi-automatic welder operator	92-69
Thereford type E			
<u>Headband mounted</u>	L		98-73
Bilson loton	M	Planer operator	106-89
Recal ultra moff 2	H	Wire brush operator	114-86
Ear 1000		Nylon hand grinder operator	
(b) Ear plugs			
Bilson soft disposable	L	Profile burner operator	93-68
Ear foam	L	Methane drainage pump house	93-70
(c) Earmuff and Earplug combined			
Ear 1000 Muff	L	Air leg borer operator	123-85
Ear plug	*	Drop hammer operator	114-78

*For use with standard safety helmets incorporating welding shields for face.

(Cir. Tech. 5/1990)

MMR 182-182 A

Use of safety helmets and protective footwear by workmen

It has been found that some workmen go into a mine without wearing safety helmets and protective footwear provided to them by the management. This shows that adequate steps are not taken at such mines to ensure strict compliance with the statutory requirements according to which no person shall go into or work, or be allowed to go into or work in a mine unless he wears the said protective equipment.

It is apparent that some persons should be specially deputed by the manager for a check at the pit-top or at mine entrance.

This duty may be entrusted either to a body-checker or banksman or an suitable person, who should be appointed in writing for this work, in addition to his other duties whenever possible.

(Cir. 74/1973)

Use of synthetic fibre clothes and non conducting footwear by Shotfirers/blasters and their helpers

Static charge can be generated and stored on bodies of persons wearing synthetic fibre clothes and/or socks and conducting shoes or boots. The potential of such charge during dry months may go upto 60,000 volts, Specially on a cold day in a dry climate. This can discharge through the detonator wire insulation to the ground if the wires touch the charged body and may lead to firing of the detonator with dangerous results.

It is , therefore , advisable to ensure that shotfirers/blasters and their helpers do not wear fibre clothes and socks whilst on duty. It should also be ensured that they are provided with and wear only non-conducting type of shoes or boots e.g. leather sole footwear.

(Cir. Tech. 1/1985)

Use of protective footwear's by female workers

It is obligatory on the part of the management of each mine that they will not allow any person to go into or work in mine unless he/she wears a protective footwear of approved type which shall be supplied free of charge by the mine management at every six months.

This holds good for the female workers who are, engaged in surface operation and in quarries.

Special type of footwear as per Indian standard 11225-1985 and duly approved by DGMS for use of female workers are available in the market.

you are once again requested to provide the above type of shoes to the female workers as per the requirement of the statute. You are also requested to ensure that no male worker is engaged in the mine unless she wears a protective footwear of the type mentioned above.

(Cir. Tech.. 8/2002)

Interval for free supply of helmets to mine workers

From time to time requests are received from the mine managements asking for extension of the interval of free supply of helmets to the mine workers. The matter has been carefully considered and by virtue of powers under Reg.191A(2) of CMR 1957 and 182A(2) of MMR 1961, the DGMS has permitted the supply and use of approved helmets for a period **not exceeding five years** in respect of the following -

- (i) workers employed in opencast workings.
- (ii) workers employed on the surface of the mines.

This permission is granted only on trial basis and may be amended or withdrawn if considered necessary in the interest of safety.

Notwithstanding anything contained in Para I, the interval of supply of helmets to the underground workers of the mines shall not exceed three years as laid down in sub-regulation (2) of Reg. 191A of CMR 1957 and 182A of MMR 1961.

(Cir. Legis. 2/1975)

MMR 182B

Use and supply of protective goggles or shields to the workers to Prevent eye injuries

Owner, Agent and Manager of every mine is required to provide the following classes of persons with protective goggles or shields fitted with unsplinterable glass or other suitable material so as to prevent eye injuries:

1. persons engaged in breaking, chipping or dressing stone, ore or any other mineral,
2. persons engaged in workshop on jobs involving work of cutting, chipping, grinding or drilling, ore, mineral or such other substance,
3. welders and their helpers, and
4. persons who are engaged in any operation in which they are exposed to the risk of injury to their eyes due to flying fragments of any substance or otherwise.

(Cir. 29/1974)

Use of gloves

Trammers and person handling machinery are exposed to the hazard of injuries to hands. In some mines gloves are being used by these categories of workers. Experience in these mines indicated that rate of accident involving hands (including fingers) could be brought down considerably by use of suitable types of gloves. In one mine, such accidents were brought down by nearly 30% by use of gloves in one year.

Accidents not only cause hardship to the injured persons but also affect productivity. In order to reduce accidents to hands, it is proposed to issue shortly a notification under Reg. 191 B of the CMR 1957 and Reg. 182B of the MMR 1961, requiring the use of gloves by all trammers and persons handling machinery in mines. Pending issue of such a notification you are advised to take action to provide suitable types of gloves to these categories of persons immediately.

As per information available from the mines where gloves are being used, a list of manufacturers of gloves is enclosed for your guidance. Some of the mines are procuring gloves from local sources. You may procure gloves from any of the sources but the same should be of good quality and suitable for use under mining conditions.

I trust you will take immediate action to comply with this directive.

(Cir. Tech. 1/1983)

ANNEXURE

LIST OF MANUFACTURERS OF GLOVES FOR USE IN MINES

1. M/s. Berco Welding & Electrical Private Ltd., Jullunder.
2. M/s. Associated Mechanical Industries, Belgaum.
3. M/s. Sersenraj Enterprise,
C/o Mr. S.K. Jain, Nag Nagar, Dhanbad.
4. M/s. Industrial Protective Equipments,
62, Bentink Street, Calcutta- 700 069.
5. M/s. Mohsin & Co., Madras.

6. M/s. Swastik Enterprises, Bangalore.
7. All India Women's Conference, Kalyan Niketan Road,
No. 19F Area, Jamshedpur.

Use of line-men's safety belt

That a safety belt should be used whenever electricians or competent persons are required to work at the top of an overhead line pole is a recognized good practice which should not normally need a reminder, However, it appears that there are still some lapses as was seen when an accident occurred in a mine recently when an electrician fell from the top of an overhead pole and received fatal injuries. The mishap could have been easily avoided if only the electrician had been provided with and used a lineman's safety belt (made to IS:3521-1955 Specification for Lineman's Safety belt and strap).

(Cir. 28/1967)

Special order under Regulation 182 B of MMR, 1961

In exercise of the powers conferred upon me under Regulation 182 B of MMR, 1961, I M.M. Sharma, Chief Inspector of Mines (also designated as Director General of Mines Safety) do hereby require you to provide following safety equipments free of cost to the persons employed in the Metalliferous Mines:-

1. Ear Plug
2. Safety Goggles (Eye wear)
3. Reflective / Visibility Harness
4. Dust Respirator
5. Shin Guard

No. 16(38)79-Genl/4066-4266 Dhanbad, dated 24.09.07

Calibration of environmental monitoring equipment

You may be aware that several environmental monitoring equipments like Methanometer, Toximeter, Oxygen monitor and multigas detectors are now being used in the coal mines for monitoring concentration of different gases in the mine atmosphere. Whereas these instruments are convenient in use they require careful handling and regular maintenance, which include periodic testing for accuracy and calibration. Defective and non-calibrated equipments used for monitoring the mine atmosphere will give incorrect and misleading results, which may create confusion during assessment of correct environmental condition and lead to major accidents & disasters.

Recently while inspecting a degree III gassy mine it was observed the concentration of methane in a race when measured with one instrument showed 0.4% while the other of the same make showed 4.0% in the same face. During the same inspection at another face the two instruments indicated 0.4% & 0.1% CH₄ respectively. Obviously the methanometers were not calibrated. I need not elaborate on the consequences of such faulty measurement. Checking the accuracy of the instruments and getting them recalibrated at regular interval would bring out any defects in the instruments. As such I would once again like to draw immediate attention of all concerned regarding correct and timely calibration of all monitoring equipments and advise that the following calibration schedule be strictly adhered to :

- a) Methanometers - Every 3 months.
- b) Toximeter, Oxymeter - Every 3 months.
- c) Multigas detector - Every 3 months.

d) All other equipments - Every 6 months.

Apart from this whenever any instrument shows maximum deflections or high readings, it shall be immediately recalibrated.

The above instruments should be maintained and calibrated by the manufacturer/suppliers of the instruments or their authorized agents or at an approved laboratory. A record of the above shall be maintained showing the date and the details of maintenance and calibration.

(Cir.Tech. 9/2002)

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