1.0 Introduction

Under the Constitution of India "Regulation of Labour and Safety in Mines and Oilfields" is a central subject (Entry 55 of the Seventh Schedule of Article 246). The matter is regulated by the Mines Act, 1952 and the Rules and Regulations framed thereunder. It extends to whole of India including territorial water i.e. upto 12 nautical miles in the sea measured from appropriate base line. These statutes are administered by Directorate-General of Mines Safety (DGMS) under the Union Ministry of Labour & Employment.

1.1 Historical Background

Although exploitation of minerals has been going on in the country from pre-Christian era, it was only towards the end of 19th Century that attempts were made by the state for regulation of employment and working conditions therein. Following the International Labour Conference in Berlin in 1890, the then Government of UK through the Secretary of State for India asked the Government of India to consider the desirability of undertaking legislation for inspection of mines in general and coal mines in particular and for regulation of employment therein of men, women and children. Accordingly in 1894, Mr. James Grundy was appointed as first ever Inspector of Mines in India within the organization of Geological Survey of India. Mr. Grundy recommended that provisions be made for the minimum age of employment; notice of opening and of accidents, first-aid, management and supervision etc. Major disasters at Kolar Gold Field in 1897 and at Khost Coal Mines, Baluchistan (presently in Pakistan) in 1898 expedited finalisation of the first Mines Act which was enacted on 22nd March, 1901. A Bureau of Mines Inspection was started in Calcutta on 7th January 1902 to administer the provisions of the Mines Act, 1901. The organization was renamed as Department of Mines and its office was shifted to Dhanbad in 1908. In 1960, the organization was renamed as Office of the Chief Inspector of Mines. Again in 1967 the name of the organization was changed to Directorate-General of Mines Safety (DGMS). In 1988 DGMS was declared a Scientific and Technological Organization.

Apart from administering the Mines Act and legislation framed thereunder, DGMS also administers certain allied legislation. A list of legislation administered by DGMS is given at **Appendix-I**.

1.2 Organizational Set-up of DGMS

Directorate-General of Mines Safety is a multi-disciplinary organization with Inspecting Officers from Mining, Mechanical and Electrical engineering and Occupational Health disciplines. Officers appointed to different technical posts in DGMS are selected by U.P.S.C. They are required to have Degree in Mining or Mechanical or Electrical Engineering with several years of experience, varying from seven to ten years of working in responsible capacity in mines or allied industry. Besides, officers of mining cadre posses First Class Mine Manager's Certificate of

Competency. The Occupational Health cadre is manned by qualified and experienced medical personnel.

The organization has its headquarters at Dhanbad (Jharkhand) and is headed by the Director-General of Mines Safety. At the headquarters, the Director-General is assisted by specialist staff-officers in mining, electrical and mechanical engineering, occupational health, law, survey, statistics, administration and accounts disciplines. The headquarters has a technical library and S&T laboratory as a back-up support to the organization. Extensive computerization has been done in head office and in the field offices to upgrade the standard of work. The head office and some of the field offices have access to the internet enabling these to place themselves at par with other developed countries of the world so far as the communication with the use of computer is concerned. DGMS has a plan to establish a network for all its offices through Internet. A web page on DGMS has already been launched during the centenary year.

The field organization has a two-tier network of field offices. The area of jurisdiction of DGMS covering the entire country is divided into 8 zones, each under the charge of a Deputy Director-General. There are three to four Regional offices under each zonal office. Each Region is under the charge of a Director of Mines Safety. There are in all 29 such Regional Offices. Sub-regional offices have been set up in important areas of concentrated mining activities away from Regional office. There are 3 such sub-regional offices, each under the charge of a Deputy Director. Each Zone, besides having inspecting officers of mining cadre has officers in electrical, mechanical engineering and occupational health disciplines.

Organization chart of DGMS are at **Appendix-IIA & IIB**. Table - 1 shows the discipline-wise strength of inspecting officers as on 31.12.2009. A statement showing posting of Group 'A' & 'B' officers in DGMS during the year 2009 are given at **Appendix-III**.

TABLE:1	**STRENGTH OF INSPECTING OFFICERS AND SANCTIONED POSTS AS ON 31.12.2009**							
DESIGNATION	DISCIPLINE							
	MINING		ELECTRICAL		MECHANICAL		O. H	
	S	P	S	P	S	P	S	P
Director General	1	1	-	-	-	-	-	-
Dy. Director General	9	7	1	1	1	-	-	-
Director	43	23	12	11	12	2	-	-
Dy. Director	94	63	29	6	26	5	4	1
Assistant Director	-	-	-	-	-	-	Gr.I-4	2
Total	**147**	**94**	**42**	**18**	**39**	**7**	**8**	**3**

S – Sanctioned P - In Position

1.3 Role and Function of DGMS

Enforcement of the provision of the Mines Act, 1952 and Rules, Regulations and Order made thereunder and drafting appropriate legislation to absorb the technical advancement as well as to make the same comprehensive, practicable and legally sound. Setting standards, by overseeing compliance thereof as intensively as the resources permit and through a variety of promotional initiatives and awareness programme, the officers of DGMS exercise preventive as well as educational influence over the mining industry. DGMS is also promoting the concept of 'self-regulation' as well as 'workers' participation in safety management. With changing scenario, attempts are being made to superimpose its traditional role of seeking compliance by legal sanctions and work prohibition optimally, with advisory and other safety promotional initiatives; thereby creating an environment in which safety is given due priority.

Current functions of DGMS broadly include:

1. Development and updating of legislation and issue of guidelines and circulars periodically.
2. Inspection – overseeing compliance of the statutes by the management through sample inspection as and when required
3. Investigation into:
   (a) accidents
   (b) dangerous occurrences - emergency response
   (c) complaints & other matters and
   (d) taking corrective action and action against delinquents
4. (a) Grant of :
   (i) statutory permission, exemptions & relaxations
   (ii) approval of mine safety equipment, material & appliances
   (b) Interactions for development of safety equipment, material and safe work practices
5. Safety promotional initiatives including:
   (a) Organization of -
      - National Conference on Safety in Mines
      - National Safety Awards
      - Safety Weeks & Campaigns
   (b) Safety Information Dissemination
   (c) Preview of project reports & mining plans
   (d) Promoting -
   i) safety education and awareness programme
   ii) workers' participation in safety management through -
      - workmen's inspector
      - safety committee
      - tripartite reviews
6. Conduct of examinations for grant of competency certificates.

1.4 Gazette Notification

Following gazette notifications were issued during the year 2009:

TABLE:2	Notification No. & date	Brief subject
1.	S.O.119(E) dated 12.1.2009	Central Government appoints officers in the Directorate General of Mines Safety as Special Public Prosecutors for the conduct of cases instituted under Mines Act, 1952.
2.	S.O.1176(E) dated 6.5.2009	Govt. appoints Shri SJ Sibal, Director-General of Mines Safety, Dhanbad to be the Chief Inspector of Mines.
3.	GSR 9 dated 13.1.2009	From 1st March, 2009 all types of lights, lighting fixtures and systems including lights on board mobile machine, in HEMMs, machinery and plants, indicators or signal lights to be used in mines both on surface and belowground including oil and gas mines/fields will be such type, standard and make as approved by a general or special order in writing.
4.	A-32012/ 01/ 2008-ISH.II dated 8.5.2009	Regarding appointment of Shri PK Sarkar and Shri Utpal Saha to the post of Dy.Director-General of Mines Safety.
5.	Law/G-22/09/ 319 dated 27.5.2009	Regarding authorization to officers of DGMS to institute prosecution for any offence under the Mines Act, 1952
6.	A-12025/05/ 2006-ISH.II dated 11.06.2009	Regarding appointment of the officers to the post of Dy.Director of Mines Safety in DGMS
7.	S.O. 2552(E) dated 8.10.2009	Re-constitution committee under section 12 of Mines Act.
8.	S.O. 3177 dated 6.11.2009	Jurisdiction of zones and regions of DGMS
9.	GSR 60 dated 4.5.2009	Bye laws for conduct of examination under MMR 1961 for Managers (R)
10.	GSR 61 dated 4.5.2009	Bye laws for conduct of examination under MMR.1961 for Surveyor (R)
11.	GSR 62 dated 4.5.2009	Bye laws for conduct of examination under MMR.1961 for Foreman (R)
12.	GSR 63 dated 4.5.2009	Bye laws for conduct of examination under MMR.1961 for Manager
13.	GSR 64 dated 4.5.2009	Bye laws for conduct of examination under MMR.1961 for Surveyor
14.	GSR 65 dated 4.5.2009	Bye laws for conduct of examination under MMR.1961 for Foreman
15.	GSR 66 dated 4.5.2009	Bye laws for conduct of examination under CMR.1957 for Manager
16.	GSR 67 dated 4.5.2009	Bye laws for conduct of examination under CMR.1957 for Surveyor
17.	GSR 68 dated 4.5.2009	Bye laws for conduct of examination under CMR.1957 for Overman

1.5 Measures to improve safety in mines:

Since mining is beset with many inherent hazards, detailed precautions have been laid down in the Mines Act, Rules and Regulations framed thereunder to guard against dangers in mines and it is the responsibility of the mine management to comply with the same. While the onus of providing for and ensuring safety in mines rests with the mine management, DGMS has the

responsibility to see that the safety statute is kept updated to absorb the technical advancements as well as to make the same comprehensive, practicable, legally sound and also to carry out periodic inspection of mines to oversee compliance of safety laws. The Mines Act and the subordinate legislations framed thereunder is periodically updated for the purpose. Each and every accident involving fatality is enquired into by an officer or a team of officers of DGMS. A few accidents involving serious bodily injury and most of the important dangerous occurrences are also investigated by DGMS Officers. Arising out of inspections and enquiries conducted by DGMS, one or more of the following actions, as appropriate, is taken: -

(a) drawing the attention of the mine management about the contraventions of the statutes etc.;
(b) withdrawal of statutory permission, approval, relaxation or exemption granted ;
(c) serving an improvement notice ;
(d) imposition of a prohibitory order ;
(e) suspension of statutory certificate of competency held by managerial and supervisory personnel, if found negligent in the discharge of duties;
(f) prosecution of person(s) held responsible;
(g) punitive action taken departmentally by mining companies.

Mine management is also addressed to take steps as are considered necessary by the inspecting/enquiry officer to rectify the defects or deficiencies in working condition or system.

1.6 Inspection & Enquiries

Discipline-wise number of inspections and enquiries made by the inspecting officers are given in table:3.

TABLE:3	**NUMBER OF INSPECTIONS AND ENQUIRIES MADE DURING THE YEAR 2009**					
Discipline of Inspection Service	Coal Mines		Metal Mines		Oil Mines	
	Inspections	Enquiries	Inspections	Enquiries	Inspections	Enquiries
Mining	2961	802	3080	340	84	-
Electrical	1051	57	147	13	164	-
Mechanical	326	29	88	19	2	52
Occupational Health	66	11	10	-	-	-
TOTAL	**4404**	**899**	**3325**	**372**	**250**	**52**

1.7 Improvement Notices & Prohibitory Orders

1.7.1 Coal Mines

117 (one hundred seventeen) improvement notices under various provisions of the statutes were issued as a result of inspections of the mines during the year 2009. These improvement

notices were issued for various types of serious defects, details of which are given in table:4 below :

TABLE:4	IMPROVEMENT NOTICES ISSUED UNDER SECTIONS 22(1) AND 22A(1) OF THE MINES ACT, 1952 IN COAL MINES DURING 2009	
SL.NO.	NATURE OF DEFECT	NO. OF CASES
1.	High benches in opencast workings	24
2.	Inadequate support	2
3.	Poor ventilation	7
4.	Inadequate coal dust suppression	9
5.	Isolation stopping	3
6.	Improper/ non-provision of travelling road	1
7.	Danger of Inundation	5
8.	Unstable workings	2
9.	Lag in stowing	1
10.	Accumulation of gases	3
11.	Defective Electrical installation	9
12.	Inadequate earth leakage protection	0
13.	Defective winding rope	0
14.	Other defects in winding installation	9
15.	Defective shot-firing practices	0
16.	Others	42
	TOTAL	**117**

30 (thirty) prohibitory orders under Section 22(3), 22A(2) and 22(1A) of the Mines Act, 1952 were issued during the year 2009. These orders were imposed for various dangerous conditions prevailing at the mines, details of which are given in table 5:

TABLE:5	PROHIBITORY ORDERS ISSUED UNDER SECTIONS 22(3) AND 22A(2) AND 22(1A) OF THE MINES ACT,1952 IN COAL MINES DURING 2009	
SL.NO.	NATURE OF DEFECT	NO. OF CASES
1.	High benches in opencast workings	14
2.	Inadequate support	1
3.	Poor ventilation	3
4.	Inadequate coal dust suppression	1
5.	Isolation stopping	0
6.	Improper/ non-provision of travelling road	0
7.	Danger of Inundation	1
8.	Unstable workings	1
9.	Lag in stowing	0
10.	Accumulation of gases	0
11.	Defective Electrical installation	1
12.	Inadequate earth leakage protection	0
13.	Defective winding rope	0
14.	Other defects in winding installation	3
15.	Defective shot-firing practices	0
16.	Others	5
	TOTAL	**30**

1.7.2 Metalliferous Mines

In metalliferous mines inadequate benching and unstable slope in opencast workings and non-appointment of manager and supervisory officials in the mines were the main reasons for which improvement notices and prohibitory orders were issued. Notices issued under Sections 22(1) & 22A(1) of the Mines Act, 1952 during the year 2009 were 32 (thirty two). Prohibitory

orders under Sections 22(1A), 22A(2) and 22(3) issued in Metalliferous Mines during the year 2009 were 50 (fifty). Details of the improvement notices and prohibitory orders issued during 2009 are given in table: 6 & 7 respectively.

TABLE:6	IMPROVEMENT NOTICES ISSUED UNDER SECTIONS 22(1) AND 22A(1) OF THE MINES ACT,1952 IN METALLIFEROUS MINES DURING 2009	
SL.NO.	NATURE OF DEFECT	No. of cases
1.	Non-appointment of qualified manager and supervisory officials	05
2.	Inadequate benching and sloping in opencast workings	13
3.	Miscellaneous	14
	TOTAL	**32**

TABLE:7	PROHIBITORY ORDERS ISSUED UNDER SECTIONS 22(3), 22A(2) & 22(1A) OF THE MINES ACT,1952 ISSUED IN METALLIFEROUS MINES DURING 2009	
SL.NO.	NATURE OF DEFECT	No. of cases
1.	Non-appointment of qualified manager and supervisory officials	21
2.	Inadequate benching and sloping in opencast workings	22
3.	Miscellaneous	07
	TOTAL	**50**

1.7.3 Oil Mines

In oil mines non-appointment of manager and supervisory officials in the mines were the main reasons for which improvement notices and prohibitory orders were issued. Notices issued under Sections 22(1) & 22A(1) of the Mines Act, 1952 during the year 2009 were 2 (two). No prohibitory orders under Sections 22(1A), 22A(2) and 22(3) issued in Oil Mines during the year 2009. Details of the improvement notices and prohibitory orders issued during 2009 are given in table: 6A & 7A respectively.

TABLE:6A	IMPROVEMENT NOTICES ISSUED UNDER SECTIONS 22(1) AND 22A(1) OF THE MINES ACT,1952 IN OIL MINES DURING 2009	
SL.NO.	NATURE OF DEFECT	No. of cases
1.	Non-appointment of qualified manager and supervisory officials	0
2.	Others	2
	TOTAL	**2**

TABLE:7A	PROHIBITORY ORDERS ISSUED UNDER SECTIONS 22(3), 22A(2) & 22(1A) OF THE MINES ACT,1952 ISSUED IN OIL MINES DURING 2009	
SL.NO.	NATURE OF DEFECT	No. of cases
1.	Non-appointment of qualified manager and supervisory officials	-
2.	Others	-
	TOTAL	**-**

1.8 Permission, relaxations and exemptions

1.8.1 Coal Mines

1004 (one thousand four) permissions/exemptions and relaxations were granted in coalmines during the year 2009. Details of such cases are given in table:8.

TABLE:8	PERMISSIONS, RELAXATIONS & EXEMPTIONS GRANTED IN COAL MINES DURING 2009	
SL.NO.	Particulars of Permissions, Relaxations & Exemptions	No. of cases
1.	Extraction of coal by methods other than bord & pillar beneath areas free from surface features	61
2.	Extraction of coal by methods other than bord & pillar below surface features	9
3.	Extraction of coal by bord & pillar methods beneath areas free from surface features	125
4.	Extraction of coal by bord & pillar methods beneath surface features	61
5.	Development below surface features including development in contiguous seams/ sections	38
6.	Blasting coal off the solid	29
7.	Development within 60m. of waterlogged workings	10
8.	Workings within 7.5m. / Adjustment of mine boundaries	32
9.	Exemptions from different provisions of regulations	155
10.	Others	484
	TOTAL	**1004**

1.8.2 Metalliferous Mines

945 (nine hundred forty-five) permissions/relaxations/exemptions under different provisions of the statutes were granted during the year 2009. Particulars are given in table:9.

TABLE:9	PERMISSION, EXEMPTIONS & RELAXATIONS GRANTED IN METALLIFEROUS MINES DURING 2009	
SL.NO.	Particulars of Permissions, Exemptions & Relaxations	No. of cases
1.	Stoping of blocks	36
2.	Use of HEMM with deep hole blasting	203
3.	Use of ANFO and/or more than one explosive in a shot hole	51
4.	Working under railways and roads	4
5.	Appointment of managers of more than one mine/ permit manager etc.	277
6.	Appointment of surveyor of more than one mine	9
7.	Others	365
	TOTAL	**945**

1.8.3 Oil Mines

162 (one hundred sixty-two) permissions/relaxations/exemptions were granted during the year 2009 under various provisions of the Oil Mines Regulations, 1984. The details of such cases are given in table:10

TABLE:10	PERMISSION, EXEMPTIONS & RELAXATIONS GRANTED IN OIL MINES DURING 2009	
SL.NO.	Particulars of Permissions, Exemptions & Relaxations	No. cases
1.	Well head installations	18
2.	Laying of oil pipe line	92
3.	Notices under Regulation 51 for GGS/EPS etc.	52
	TOTAL	**162**

1.9 Prosecutions

14 (fourteen) prosecutions were instituted in coalmines during the year 2009. In respect of non-coal mines, 25 (twenty five) prosecutions were launched during 2009. Contraventions of provisions of statute for which these prosecutions were instituted are given in tables: 11 & 12.

Details of prosecution cases as on 31.12.2009.

Coal	Non-coal	Pending	Disposed
No. of prosecution launched during the year 2009	No. of prosecution launched during the year 2009	Total pending cases upto 31.12.2009	Total disposed cases upto 31.12.2009
14	25	905	476

TABLE:11	PROSECUTIONS INSTITUTED IN RESPECT OF COAL MINES DURING 2009	
SL.NO.	CONTRAVENTION	NO. OF CASES
1.	Contraventions leading to accidents	10
2.	Non-submission or submission of incorrect plans, returns, notices etc.	-
3.	Non-appointment of qualified persons as senior supervisory officials	-
4.	Contraventions under Indian Electricity Act or Rules	1
5.	Other violation of serious nature	3
6.	Miscellaneous violations	-
	TOTAL	**14**

TABLE:12	PROSECUTIONS INSTITUTED IN RESPECT OF NON-COAL MINES DURING 2009	
SL NO.	CONTRAVENTION	NO. OF CASES
1.	Contravention leading to accidents	19
2.	Contravention of orders under sections 22(1A), 22(3), Reg. 108 etc.	1
3.	Non-appointment of qualified persons as senior supervisory officials	1
4.	Non-appointment of qualified persons as subordinate supervisory officials	-
5.	Non-provisions of protective equipment	-
6.	Other miscellaneous contraventions	4
	TOTAL	**25**

2.0 Coal Mines

2.1 General

Number of operating coalmines during 2009 was 583 as compared to 569 in 2008. Company-wise number of coal mines and production is given in table: 13.

TABLE: 13	Number of Mines during 2009				Production (in million tonnes)
COMPANY	**Underground**	**Opencast**	**Both**	**Total**	
Coal India Limited	281	163	32	476	421
Singareni Collieries Company Limited	46	17	1	64	61
Others	10	30	3	43	77
TOTAL	**337**	**210**	**36**	**583**	**559**

Table-14 shows the number of underground coalmines having gassy seams of different degrees.

TABLE : 14	UNDERGROUND COAL MINES HAVING GASSY SEAMS OF DIFFERENT DEGREES	
Degree of gassiness	**Number of Mines**	
	2008	**2009***
I only	249	265
II only	104	90
III only	13	11
I & II	5	3
I & III	-	-
II & III	4	4
I, II & III	-	-
TOTAL	**375**	**373**

*Provisional

During the year total numbers of working mines have increased from 569 in 2008 to 569 in 2009. Output of coal increased from 506.00 million tonnes in 2008 to 559.00 million tonnes in 2009. Coal mines under M/s.Coal India Limited contributed 421.00 million tonnes of coal during the year 2009. Average daily employment in mines increased from 369,000 in 2008 to 374,000 in 2009. The output per manshift was increased from 4.25 in 2008 to 4.67 during 2009. Trend in average daily employment and output per manshift in coalmines is given table: 15.

TABLE: 15	PLACEWISE DISTRIBUTION OF AVERAGE DAILY EMPLOYMENT AND OUTPUT AND PRODUCTIVITY IN COAL MINES							
Year	Belowground		Opencast		Above Ground	Total		Output per manshift
	Employment (in '000 number	Output (in '000 tonnes)	Employment (in '000 number	Output (in '000 tonnes)	Employment (in '000 number)	Employment (in '000 number)	Output (in '000 tonnes)	
1951	178	30199	36	4784	138	352	34983	0.35
1961	230	44887	60	10822	121	411	55709	0.45
1971	228	58552	43	17090	111	382	75642	0.67
1981	302	76205	55	51120	156	513	127325	0.81
1991	316	70731	67	167206	171	554	237757	1.40
1992	312	71062	67	178879	173	552	249941	1.47
1993	308	73672	68	186935	170	546	260607	1.53
1994	293	70644	67	196878	164	524	267522	1.63
1995	287	68512	68	216074	158	513	284586	1.80
1996	281	70127	68	233970	157	506	304097	1.91
1997	279	69062	68	247619	156	503	316681	2.01
1998	270	68571	69	251324	152	491	319895	2.09
1999	258	68101	71	247088	147	476	315189	2.12
2000	249	66225	69	268092	140	458	334317	2.34
2001	239	64134	69	277379	130	438	341513	2.51
2002	225	65330	69	297982	129	423	363312	2.75
2003	216	63632	69	315556	132	417	379188	2.91
2004	211	61921	70	347347	124	405	407268	3.19
2005	205	64087	70	356758	124	399	420845	3.35
2006	196	61213	76	369120	114	386	430333	3.50
2007	188	62302	80	418821	111	379	481123	3.95
2008	187	66290	77	440004	105	369	506294	4.25
2009*	186	66835	80	491981	108	374	558816	4.67

*Provisional

2.2 Accidents

2.2.1 Major Accidents

No major accidents took place during the year 2009.

2.2.2 Accident scenario

During the year 2009 number of fatal accidents slightly increased and fatalities were same as compared to the year 2008. Number of fatal accidents during the year 2009 was 83 and number of fatalities was 93 whereas in the year 2008 number of fatal accidents and fatalities were 80 and 93 respectively.

Table 16 indicates the trend of accidents and rates of fatalities.

TABLE: 16	TREND IN FATAL ACCIDENTS AND FATALITY RATES PER 1000 PERSONS EMPLOYED IN COAL MINES (10 YEARLY AVERAGE)			
YEAR	Av. No. of accidents	Accident rate	Av. No. of fatality	Fatality rate
1901-1910	74	0.77	92	0.94
1911-1920	138	0.94	176	1.29
1921-1930	174	0.99	219	1.24
1931-1940	172	0.98	228	1.33
1941-1950	236	0.87	273	1.01
1951-1960	222	0.61	295	0.82
1961-1970	202	0.48	260	0.62
1971-1980	187	0.46	264	0.55
1981-1990	162	0.30	186	0.35
1991-2000	140	0.27	170	0.33
2001-2009*	86	0.21	107	0.27

*Provisional

Table 17 gives year-wise fatal accidents, fatalities, and death rates in coalmines.

TABLE: 17	TREND IN FATAL ACCIDENTS AND DEATH RATES IN COAL MINES (YEAR-WISE)				
Year	No. of fatal accidents	No. of persons killed	Death Rate		
			Per '000 persons employed	Per 100,000 manshifts worked	Per million tonnes output
1951	278	319	0.91	0.32	9.12
1961	222	268	0.65	0.22	4.81
1971	199	231	0.60	0.21	3.05
1981	165	184	0.36	0.12	1.45
1991	138	143	0.26	0.08	0.60
1992	165	183	0.33	0.11	0.73
1993	156	176	0.32	0.10	0.68
1994	156	241	0.46	0.15	0.90
1995	137	219	0.43	0.14	0.77
1996	131	146	0.29	0.09	0.48
1997	143	165	0.33	0.10	0.52
1998	128	146	0.30	0.10	0.46
1999	127	138	0.29	0.09	0.44
2000	117	144	0.31	0.10	0.43
2001	105	141	0.32	0.10	0.41
2002	81	97	0.23	0.07	0.27
2003	83	113	0.27	0.09	0.30
2004	87	96	0.24	0.07	0.23
2005	96	117	0.29	0.09	0.28
2006	78	137	0.36	0.11	0.32
2007	76	78	0.21	0.06	0.16
2008*	80	93	0.25	0.08	0.18
2009*	83	93	0.25	0.08	0.18

* Provisional

In the year 2009 number of serious accidents and number of persons seriously injured was decreased as compared to the year 2008. Number of serious accidents and number of persons injured were 636 and 660 as compared to 686 and 709 respectively during the year 2008. As far as the serious accident rate is concerned, it has decreased. The serious injury rate per thousand persons employed in 2009 was 1.79 as compared to 1.92 in 2008. The above rate per lakh manshifts worked was also decreased to 0.55 in 2009 from 0.59 in 2008. Similarly, the rate per million tonnes output decreased to 1.30 in 2009 from 1.40 in 2008.

Table 18 gives year-wise number of serious accidents, no. of persons injured and serious injury rate.

TABLE: 18	TREND IN SERIOUS ACCIDENTS AND SERIOUS INJURY RATES IN COAL MINES (YEAR-WISE)				
Year	No. of serious accidents	No. of persons seriously injured	Serious injury rates		
			Per '000 persons employed	Per 100,000 manshifts worked	Per million tonnes output
1991	803	854	1.54	0.50	3.59
1992	810	894	1.62	0.53	3.58
1993	854	903	1.65	0.68	3.46
1994	717	775	1.48	0.47	2.90
1995	757	813	1.58	0.51	2.86
1996	677	723	1.43	0.45	2.38
1997	678	726	1.44	0.46	2.29
1998	523	560	1.14	0.37	1.75
1999	595	650	1.37	0.44	2.06
2000	661	707	1.54	0.49	2.11
2001	667	720	1.64	0.53	2.10
2002	629	665	1.57	0.50	1.83
2003	563	590	1.42	0.45	1.56
2004	962	991	2.45	0.77	2.42
2005	1106	1138	2.85	0.91	2.70
2006	861	891	2.31	0.73	2.07
2007	923	951	2.51	0.78	1.98
2008*	686	709	1.92	0.59	1.40
2009*	636	660	1.79	0.55	1.30

* Provisional

Note : No. of seriously injureds of fatal accidents are also considered for computation of no. of persons seriously injured & serious injury rates.

2.2.3 Analysis of accidents

All fatal accidents and major serious accidents were inquired into by officers of DGMS. An analysis of accidents enumerated in the following paragraphs is based on the findings of such enquiry and information submitted by the mine management.

2.2.3A By place

Total 83 fatal accidents involving 93 fatalities occurred during the year 2009 as compared to 80 fatal accidents and 93 fatalities during the year 2008. Overall fatality rate has remained unchanged in 2008 & 2009. Overall serious injury rate during the year 2009 has decreased to 1.79 from 1.92 in 2008. 39(47%) fatal accidents occurred in belowground workings with fatality rate of 0.25, 29(35%) in opencast workings with fatality rate of 0.41 and 15(18%) in surface operation with fatality rate of 0.14 during the year 2009. Table 19 gives the trend of fatal and serious accidents with fatality rate in different working places.

TABLE: 19	TREND IN FATAL & SERIOUS ACCIDENTS AND DEATH & SERIOUS INJURY RATES; (PLACEWISE) - COAL MINES PER THOUSAND PERSONS EMPLOYED							
YEAR	Fatal accidents & death rates				Serious accidents & ser. injury rates			
	Below ground	Open cast	Above ground	Overall	Below ground	Open cast	Above ground	Overall
1991	80 (0.26)	25 (0.39)	33 (0.20)	138 (0.26)	577 (1.96)	60 (1.00)	166 (0.98)	803 (1.54)
1992	107 (0.39)	32 (0.52)	26 (0.18)	165 (0.33)	587 (2.14)	49 (0.79)	174 (1.01)	810 (1.62)
1993	101 (0.39)	24 (0.37)	31 (0.19)	156 (0.32)	632 (2.19)	57 (0.83)	165 (1.01)	854 (1.65)
1994	93 (0.59)	39 (0.64)	24 (0.15)	156 (2.08)	560 (2.08)	50 (0.86)	107 (0.67)	717 (1.48)
1995	91 (0.60)	26 (0.38)	20 (0.13)	137 (0.43)	549 (2.07)	69 (1.05)	139 (0.93)	757 (1.58)
1996	75 (0.31)	27 (0.42)	29 (0.19)	131 (0.29)	478 (1.83)	71 (1.10)	128 (0.86)	677 (1.43)
1997	94 (0.41)	27 (0.42)	22 (0.14)	143 (0.33)	440 (1.71)	79 (1.25)	158 (1.05)	677 (1.44)
1998	80 (0.36)	24 (0.35)	24 (0.16)	128 (0.30)	346 (1.41)	72 (1.06)	105 (0.70)	523 (1.14)
1999	74 (0.33)	30 (0.43)	23 (0.16)	127 (0.29)	408 (1.73)	77 (1.19)	110 (0.81)	595 (1.37)
2000	62 (0.30)	38 (0.74)	17 (0.13)	117 (0.31)	444 (1.92)	108 (1.67)	109 (0.82)	661 (1.54)
2001	67 (0.43)	26 (0.38)	12 (0.10)	105 (0.32)	464 (2.10)	73 (1.12)	130 (1.07)	667 (1.64)
2002	48 (0.27)	22 (0.32)	11 (0.11)	81 (0.23)	434 (2.07)	92 (1.43)	103 (0.80)	629 (1.57)
2003	46 (0.33)	23 (0.35)	14 (0.13)	83 (0.27)	380 (1.85)	82 (1.30)	101 (0.77)	563 (1.42)
2004	49 (0.27)	32 (0.47)	06 (0.05)	87 (0.24)	757 (3.69)	82 (1.24)	123 (1.02)	962 (2.45)
2005	50 (0.34)	28 (0.42)	18 (0.15)	96 (0.29)	843 (4.23)	98 (1.45)	165 (1.37)	1106 (2.85)
2006	44 (0.52)	24 (0.33)	10 (0.09)	78 (0.36)	646 (3.40)	88 (1.30)	127 (1.11)	861 (2.31)
2007	25 (0.13)	35 (0.46)	16 (0.14)	76 (0.21)	717 (3.91)	83 (1.10)	123 (1.15)	923 (2.51)
2008*	32 (0.21)	29 (0.45)	19 (0.18)	80 (0.25)	516 (2.87)	74 (0.98)	96 (0.92)	686 (1.92)
2009*	39 (0.25)	29 (0.41)	15 (0.14)	83 (0.25)	490 (2.71)	50 (0.70)	96 (0.95)	636 (1.79)

* Provisional

Note : i) Figures in bracket indicate death/injury rate.

ii) No. of seriously injured of fatal accidents are also considered for computation of no. of persons seriously injured & serious injury rates.

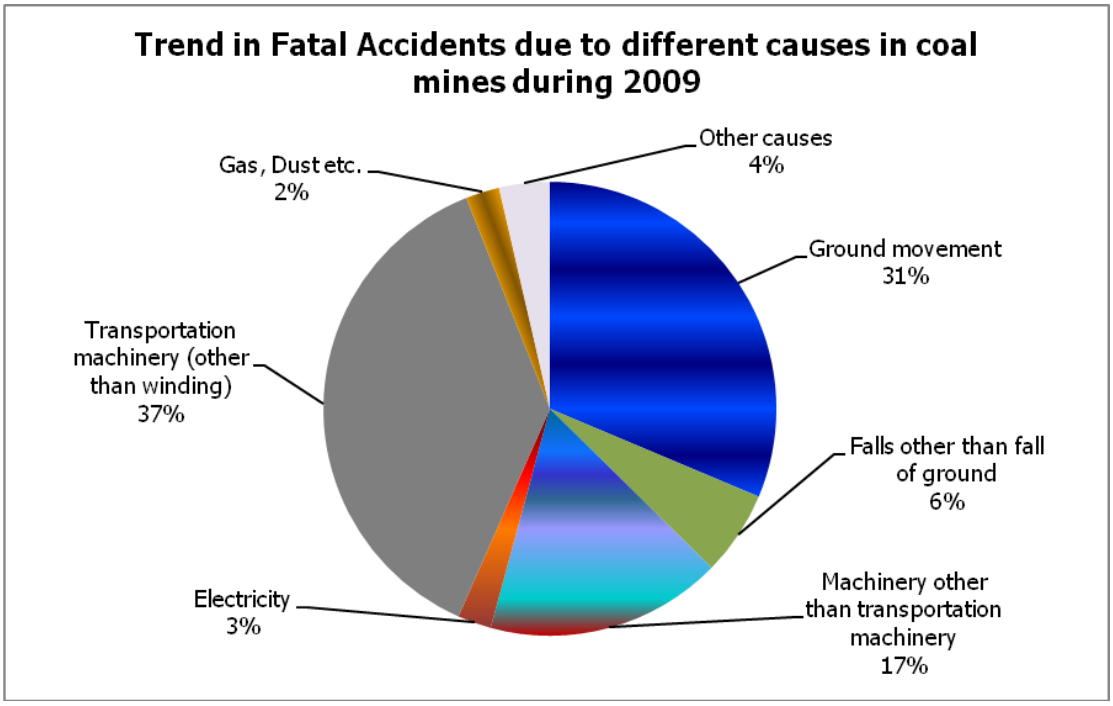
2.2.3B By cause

Tables 20 & 21 give the trend in fatal and serious accidents in coal mines due to different causes during the year 2009 followed by graphical representation. As can be seen 31(37%) of fatal accidents were caused by transportation machinery (other than winding), 26(31%) due to ground movement, 14(17%) due to machinery other than transportation machinery, 5(06%) due to falls other than ground movement, while electricity contributed 2(2.5%) and gas, dust etc. contributed 2(2.5%). 636 serious accidents occurred during the year out of which

309(49%) were caused by falls other than falls of ground, transportation machinery (other than winding) contributed 103(16%) and 57(9%) caused due to ground movement.

TABLE:20	TREND IN FATAL ACCIDENTS DUE TO DIFFERENT CAUSES IN COAL MINES				
Cause	2005	2006	2007	2008*	2009*
Ground movement	25 (32)	18 (27)	17 (17)	21 (28)	26 (32)
Winding in shafts	-	3 (3)	-	1 (1)	-
Transportation machinery (other than winding)	34 (35)	25 (26)	29 (31)	28 (29)	31 (31)
Machinery other than transportation machinery	15 (15)	8 (8)	12 (12)	10 (10)	14 (14)
Explosive	2 (2)	-	1 (1)	1 (1)	-
Electricity	4 (4)	3 (3)	4 (4)	5 (6)	2 (2)
Gas, Dust etc.	-	4 (53)	2 (2)	2 (6)	2 (4)
Falls other than fall of ground	14 (14)	12 (12)	9 (9)	10 (10)	5 (5)
Other causes	2 (15)	5 (5)	2 (2)	2 (2)	3 (5)
TOTAL	**96 (117)**	**78 (137)**	**76 (78)**	**80 (93)**	**83 (93)**

Note: Figures in parentheses denote the number of persons killed.
* Figures are provisional



Note: Figures in parentheses denote the number of persons killed.
* Figures are provisional

TABLE:20A	TREND IN FATAL ACCIDENTS IN DIFFERENT PLACES OF COAL MINES				
Place	**2005**	**2006**	**2007**	**2008***	**2009***
Belowground	50 (70)	44 (102)	25 (25)	32 (39)	39 (46)
Opencast	28 (29)	24 (25)	37 (37)	29 (35)	29 (32)
Aboveground	18 (18)	10 (10)	16 (16)	19 (19)	15 (15)
Total	**96 (117)**	**78 (137)**	**76 (78)**	**80 (93)**	**83 (93)**

TABLE: 21	TREND IN SERIOUS ACCIDENTS DUE TO DIFFERENT CAUSES IN COAL MINES				
Cause	**2005**	**2006**	**2007**	**2008***	**2009***
Ground movement	84 (102)	56 (70)	70 (78)	69 (73)	57 (68)
Winding in shafts	2 (2)	5 (7)	2 (11)	0 (0)	3 (4)
Transportation machinery (other than winding)	218 (222)	267 (280)	198 (202)	126 (128)	103 (108)
Machinery other than transportation machinery	46 (46)	54 (54)	79 (81)	40 (42)	36 (37)
Explosive	5 (6)	1 (1)	4 (4)	1 (1)	3 (5)
Electricity	5 (12)	5 (5)	3 (6)	0 (0)	2 (2)
Gas, Dust etc.	-	1 (1)	1 (1)	0 (14)	1 (2)
Falls other than fall of ground	550 (552)	375 (376)	456 (458)	351 (352)	309 (312)
Other causes	196 (196)	97 (97)	110 (110)	99 (99)	122 (122)
TOTAL	**1106(1138)**	**861 (891)**	**923 (951)**	**686 (709)**	**636 (660)**

* Figures are provisional

Note: Figures in parentheses denote the number of persons seriously injured and it includes seriously injureds from fatal accidents also.

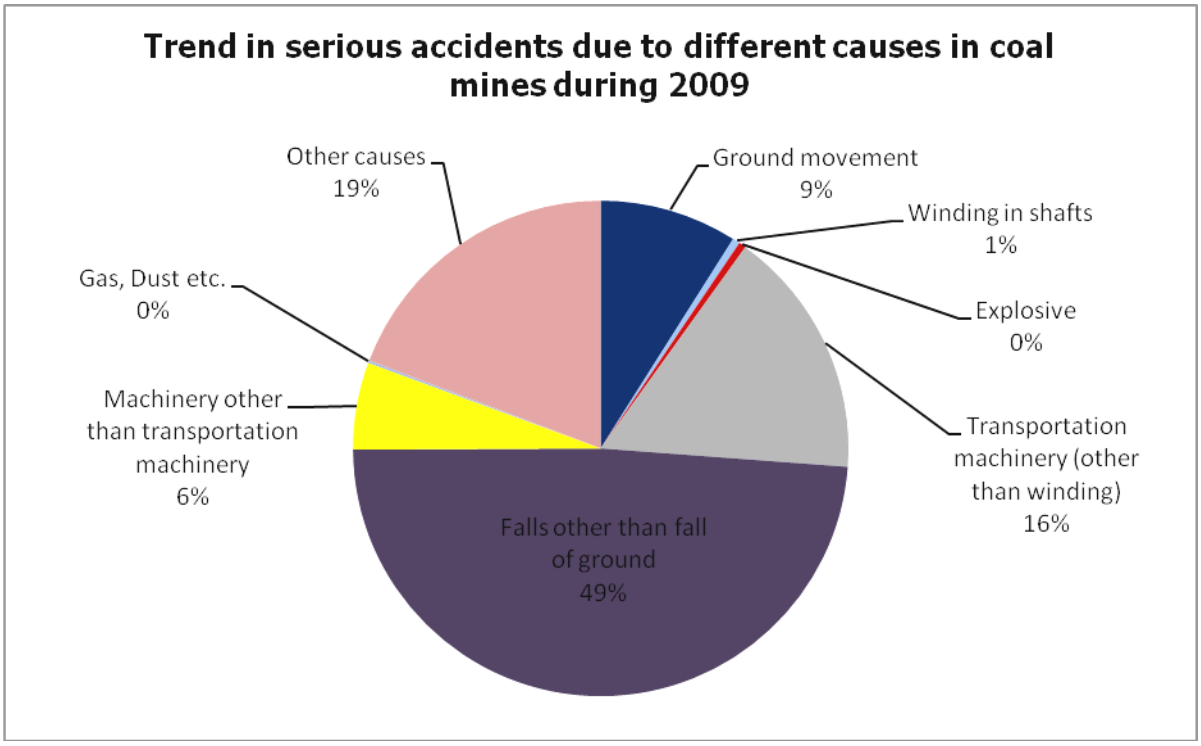


TABLE: 21A	TREND IN SERIOUS ACCIDENTS DUE TO DIFFERENT PLACES IN COAL MINES				
Place	**2005**	**2006**	**2007**	**2008***	**2009***
Belowground	843 (867)	646 (665)	717 (735)	516 (536)	490 (506)
Opencast	98 (101)	88 (99)	83 (88)	74 (76)	50 (54)
Aboveground	165 (170)	127 (127)	123 (128)	96 (97)	96 (100)
Total	**1106 (1138)**	**861 (891)**	**923 (951)**	**686 (709)**	**636 (660)**

* Figures are provisional

Note: Figures in parentheses denote the number of persons seriously injured and it includes seriously injured from fatal accidents also.

2.2.3B.1 Ground movement

During the year 2009, ground movement accounted for 26(31%) fatal accidents and 57(9%) serious accidents. Further break-up of fatal accidents due to ground movement is given in table 22.

TABLE: 22	FATAL ACCIDENTS DUE TO GROUND MOVEMENT IN COAL MINES DURING THE YEAR 2009		
Cause	No. of accidents	Persons killed	Persons seriously inj.
1.Fall of roof	17	21	6
2.Fall of side			
(a) belowground	6	7	-
(b) opencast	1	1	-
Sub-Total	**7**	**8**	**-**
3.Others			
(a) bumps	0	0	-
(b) air blast	0	0	-
(c) land slide	1	2	-
(d) collapse of pillar	0	0	-
(e) over hang	1	1	1
Sub-Total	**2**	**3**	**-**
GRAND TOTAL	**26**	**32**	**7**

2.2.3B.2 Roof fall

Strata control is a major problem affecting safety and productivity in underground mines. Experience of the past clearly brings out that roof fall is one of the predominant causes of fatalities in belowground coal mines and that trend continues even today. There were 26 accidents due to ground movement involving 32 fatalities and 07 serious injuries during the year 2009, out of which 17 accidents were due to fall of roof, 7 accidents were due to fall of side and 01 each due to landslide and over hangs. Roof fall accidents accounted for 20% of all fatal accidents in coal mines and it contributed 44% of all fatal accidents in belowground operations. Further critical analysis of roof fall accidents for the last five years 2005 to 2009 revealed the following:

I. Physical and Working Condition factors -

1. **Method of work:** Accident mainly occurred in Bord and Pillar districts. 45% of the fatal accidents occurred in B&P development, 45% in depillaring districts (35% in caving districts and 10% in stowing districts), 2% in longwall stowing and 7% in other places.
2. **Height of working:** 80% of the fatal accidents occurred in gallery height upto 3m, 20% in 3m to 5m.
3. **Width of gallery:** 2% of the fatal accidents occurred in width of galleries between 0 - 3.0m and 4% in width between 3.01 -3.5m, 17% between 3.51-4.00m, 40% between 4.01 -4.50m and 35% occurred in width of galleries above 4.50 m.
4. **Distance from face:** 42% of the accidents occurred within 5m of the working face and 15% each between 5.01 to 10m and 20.01m & above, 8% in 10.01m to 20.00m.

Thus 57% of the accident occurred within 10m of the freshly exposed roof from the face of working.

5. **Type of support:** 18% of the fatal accidents occurred in areas supported by timber support only, 4% in timber & steel supports, 22% in roof bolts & others and 56% in other supports. However, areas supported by roof bolts were more prone for roof fall. Steel supports, especially roof bolts, are more stable if they are fixed properly and in time.
6. **Adequacy of support:** Accident analysis revealed that in 60% of cases supports provided was inadequate, which means sufficient number of supports were not provided before engaging persons at work and majority of the accidents could have been averted had proper supports were provided before engaging the persons at work and front line supervisors been attentive for providing adequate supports. It also reveals that in 36% cases accident occurred although adequate support was provided.
7. **Operation at the time of accident:** 15% of the fatal accidents occurred during loading (manual) operation, 12% during dressing, 7% during supporting and 4% during dressing & supporting, thus 38% of the accidents occurred during primary job of face preparation and manual loading. This can be avoided by adequately training the face workers for paying more attention towards identification of bad roof and testing for its weakness and by providing temporary supports before erecting permanent support. 11% each of the fatal accidents occurred during withdrawal of support, 13% occurred during loading by machine and 20% due to other activities.
8. **Time elapsed after blasting:** 26% of the roof fall accidents occurred within 30 minutes of blasting operation which correlates with the operation at the time of accident as mentioned above. This also means that sufficient time was not allowed for the roof to settle before engaging persons. 6% of the fatal accidents occurred between ½ - 1 hour, 11% between 1 to 2 hours and 29% of the fatal accidents occurred beyond 2 hours of blasting operation and in 28% of cases no blasting operation was carried out.

II. Geological factors -

9. **Thickness of seam:** 40% of the fatal accidents occurred in coal seam having thickness upto 3.0 m., 33% in 3 to 6 m. and 11% in seams with thickness between 6-9m. Thus roof fall occurred in all types of coal seams irrespective of their thickness.
10. **Depth of cover:** 33% of the fatal accidents accounted in depth of cover upto 100 m, 36% in 101 to 200m. and 22% between 201 to 300. Practically roof fall accidents occurred at every place irrespective of the depth in proportion to the working plan at various depths except for depth of cover above 401m.
11. **Thickness of fall:** 17% of the fatal accidents occurred having thickness of fallen strata varying between 0 to 0.15m, 32% between 0.16 to 0.30 m. Thus 49% of

accidents had thickness of fall between 0 to 0.3m. 33% of fatal accident occurred having thickness of fallen strata between 0.31 to 1.0 m thick and 18% occurred beyond 1.00m thick. Fall of roof was mainly due to geological reasons such as presence of slicken sides, hidden slip planes, or due to weathering of strata etc. which could have been effectively controlled had adequate and timely supports been provided.

12. **Nature of fallen strata:** 46% of the fatal accidents occurred due to fall of sand stone roof, 20% due to shale and 18% due to coal and rest of the fatal accidents occurred due to combination of any two. It indicates that practically all types of roof are likely to fall in absence of adequate supports.

III. Personal factors -

13. **Designation:** 38% of the persons involved in roof fall accidents were loader, 18% timbermen, 10% subordinate supervisory staff, 9% dressers and 3% shotfirer/explosive carrier. Mainly face workers were involved in the accidents as they are first to approach the face and stay beneath the green roof areas for longer duration.
14. **Age:** In 28% of the total accidents persons involved were in the age group of 46-50 years, 15% between 41-45 years, 17% between 56-60 years, 13% between 36-40 and 12% between 51-55 years.
15. **Shift of working:** 60% of the fatal accidents took place in 1^{st} shift, 22% in 2^{nd} shift and 18% 3^{rd} shift. Thus it is observed that roof fall occurred mainly in first shift due to more number of persons employed during day time.
16. **Hours at work:** 18% of the roof fall accidents occurred each in 3.01 – 4.00 and 4.01 – 5.00 hours of the work, 15% between 5.01 – 6.00 hours and 7% between 6.01 – 7.00 hours. Thus 36% of the roof fall accidents occurred between third and fifth hours of the shift.

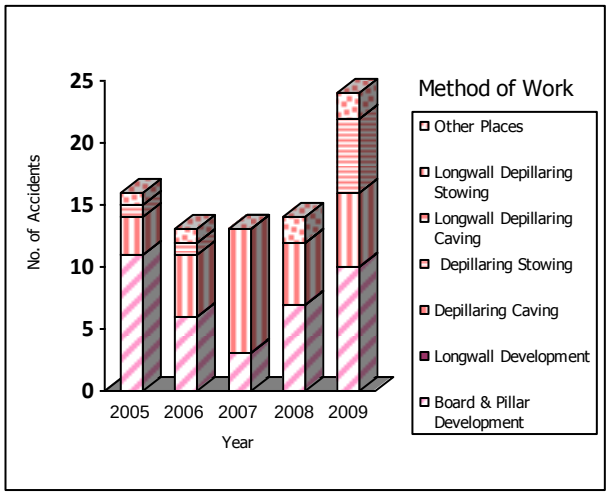
IV. Management factors -

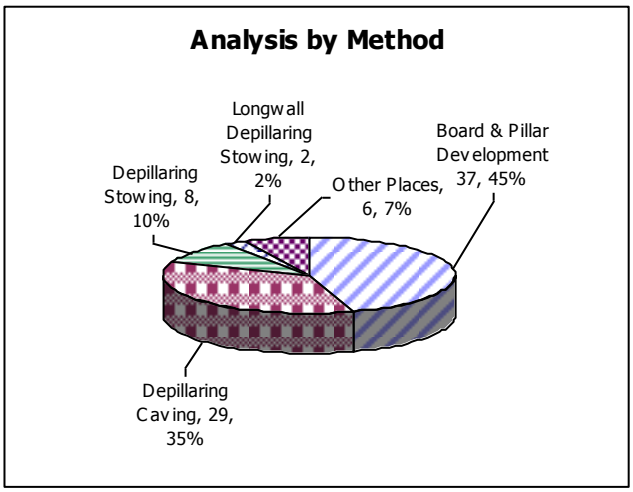
17. **Responsibility:** 44% of the fatal accidents were caused due to fault of management and Subordinate Supervisory Staff; 17% of the fatal accidents due to fault of Subordinate Supervisory Staff alone, 5% due to fault of management and others and in 4% of the cases subordinate supervisory staff and other were held responsible. In 5% of cases deceased was responsible.
18. **Company:** Company-wise analysis indicates that 73% of roof fall accident occurred in CIL whereas 20% occurred in SCCL. CIL subsidiary-wise 24% of fatal accidents occurred in BCCL, 18% in SECL, 11% in ECL, and 14% in WCL.

Detailed statistical analysis of roof fall accidents that occurred during last 5 years are given in tabular as well as graphically in the following tables:

1. Distribution of fatal roof fall accidents by method of work

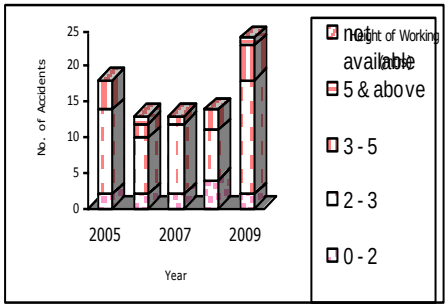
Method of work	Number of accidents											
	2005	**%**	**2006**	**%**	**2007**	**%**	**2008**	**%**	**2009**	**%**	**total**	**%**
Board & Pillar Development	11	61	6	46	3	23	7	50	10	42	**37**	45
Longwall Development	0	0	0	0	0	0	0	0	0	0	**0**	0
Depillaring												
Caving	3	17	5	38	10	77	5	36	6	25	**29**	35
Stowing	1	6	1	8	0	0	0	0	6	25	**8**	10
Total Depillaring	4	23	6	46	10	77	5	36	12	50	**37**	45
Longwall												
Depillaring												
Caving	0	0	0	0	0	0	0	0	0	0	**0**	0
Stowing	2	11	0	0	0	0	0	0	0	0	**2**	2
Total Longwall	2	11	0	0	0	0	0	0	0	0	**2**	2
Other Places	1	5	1	8	0	0	2	14	2	8	**6**	7
Total	**18**	**100**	**13**	**100**	**13**	**100**	**14**	**100**	**24**	100	**82**	100

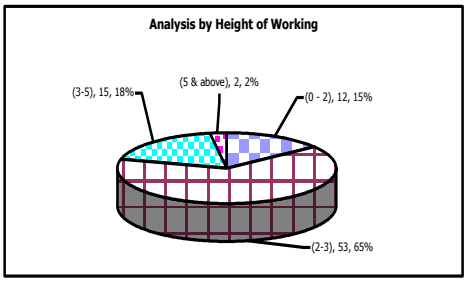




2. Distribution of fatal roof fall accidents by height of working

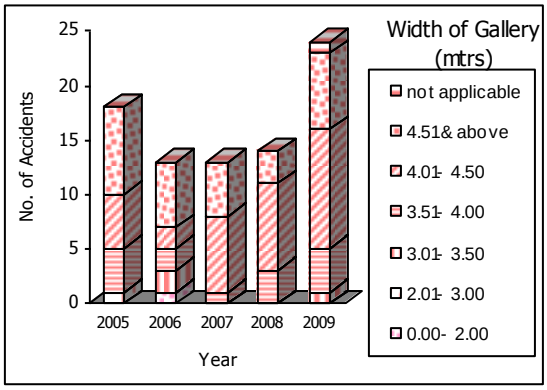
Height of working (metres)	Number of accidents											
	2005	%	2006	%	2007	%	2008	%	2009	%	total	%
0 - 2	2	11	2	15	2	15	4	29	2	8	12	15
2 - 3	12	67	8	62	10	77	7	50	16	67	53	65
3 - 5	4	22	2	15	1	8	3	21	5	21	15	18
5 & above	0	0	1	8	0	0	0	0	1	4	2	2
not available	0	0	0	0	0	0	0	0	0	0	0	0
Total	**18**	**100**	**13**	**100**	**13**	**100**	**14**	**100**	**24**	**100**	**82**	**100**

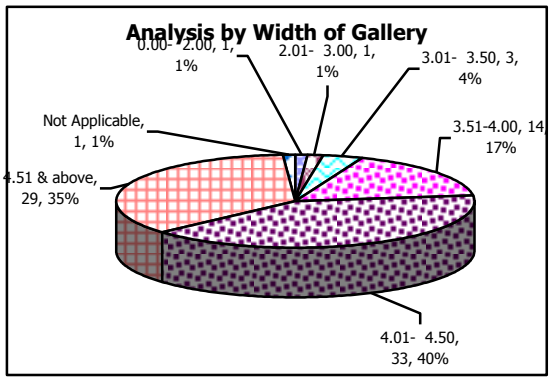




3. Distribution of fatal roof fall accidents by width of gallery

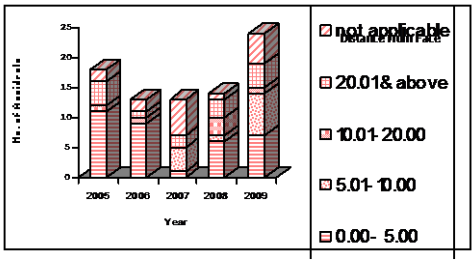
width of gallery	Number of accidents											
(metres)	2005	%	2006	%	2007	%	2008	%	2009	%	total	%
0.00- 2.00	0	0	1	8	0	0	0	0	0	0	**1**	1
2.01- 3.00	1	6	0	0	0	0	0	0	0	0	**1**	1
3.01- 3.50	0	0	2	15	0	0	0	0	1	4	**3**	4
3.51- 4.00	4	22	2	15	1	8	3	21	4	17	**14**	17
4.01- 4.50	5	28	2	15	7	54	8	58	11	46	**33**	40
4.51 & above	8	44	6	47	5	38	3	21	7	29	**29**	35
not applicable	0	0	0	0	0	0	0	0	1	4	**1**	1
Total	**18**	**100**	**13**	**100**	**13**	**100**	**14**	**100**	**24**	**100**	**82**	**100**

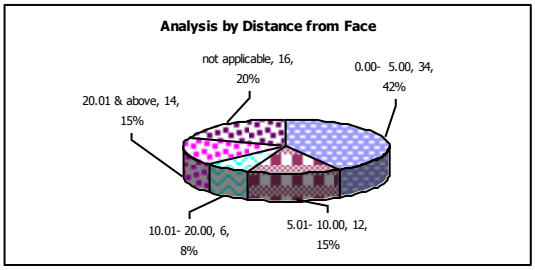




4. Distribution of fatal roof fall accidents by distance from face

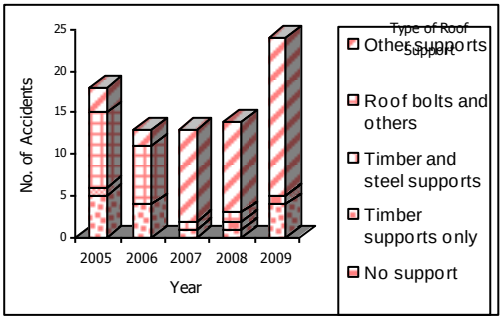
Distance from face	Number of accidents											
(metres)	2005	%	2006	%	2007	%	2008	%	2009	%	total	%
0.00- 5.00	11	61	9	69	1	8	6	44	7	29	**34**	42
5.01- 10.00	0	0	0	0	4	31	1	7	7	29	**12**	15
10.01- 20.00	1	6	1	8	0	0	3	21	1	4	**6**	8
20.01 & above	4	22	1	8	2	15	3	21	4	17	**14**	15
not applicable/ available	2	11	2	15	6	46	1	7	5	21	**16**	20
Total	**18**	**100**	**13**	**100**	**13**	**100**	**14**	**100**	**24**	**100**	**82**	**100**

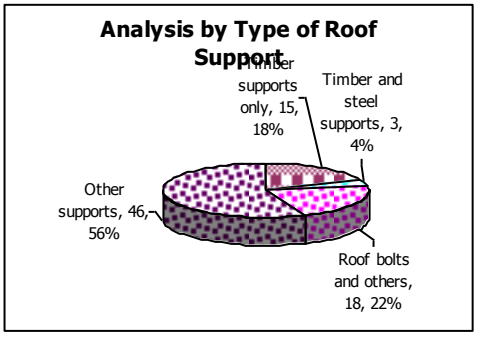




5. Distribution of fatal roof fall accidents by type of roof support

Type of support	Number of accidents											
	2005	%	2006	%	2007	%	2008	%	2009	%	total	%
No support	0	0	0	0	0	0	0	0	0	0	**0**	0
Timber supports only	5	28	4	31	1	8	1	7	4	17	**15**	18
Timber and steel supports	1	6	0	0	0	0	1	7	1	4	**3**	4
Roof bolts and others	9	50	7	54	1	8	1	7	0	0	**18**	22
Other supports	3	16	2	15	11	84	11	79	19	79	**46**	56
Total	**18**	**100**	**13**	**100**	**13**	**100**	**14**	**100**	**24**	**100**	**82**	**100**

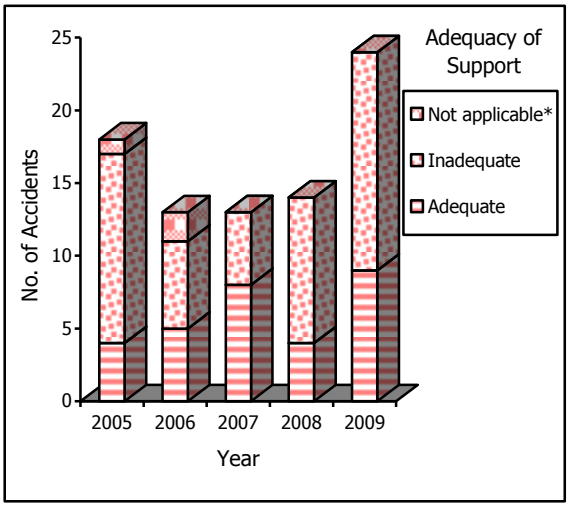


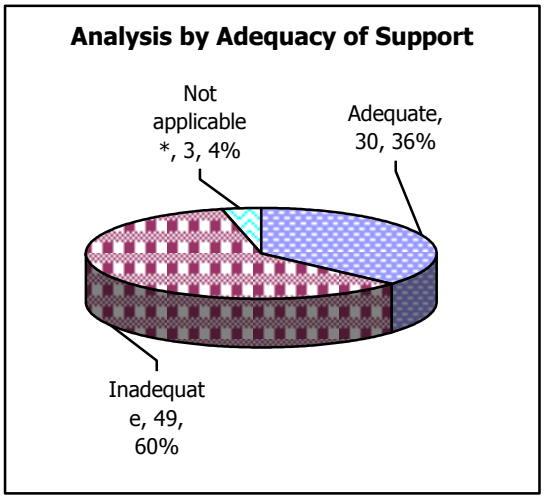


6. Distribution of fatal roof fall accidents by adequacy of support

Adequacy of support	Number of accidents											
	2005	%	2006	%	2007	%	2008	%	2009	%	total	%
Adequate	4	22	5	38	8	62	4	29	9	37	30	36
Inadequate	13	72	6	46	5	38	10	71	15	63	49	60
Not applicable*	1	6	2	16	0	0	0	0	0	0	3	4
Total	**18**	**100**	**13**	**100**	**13**	**100**	**14**	**100**	**24**	**100**	**82**	**100**

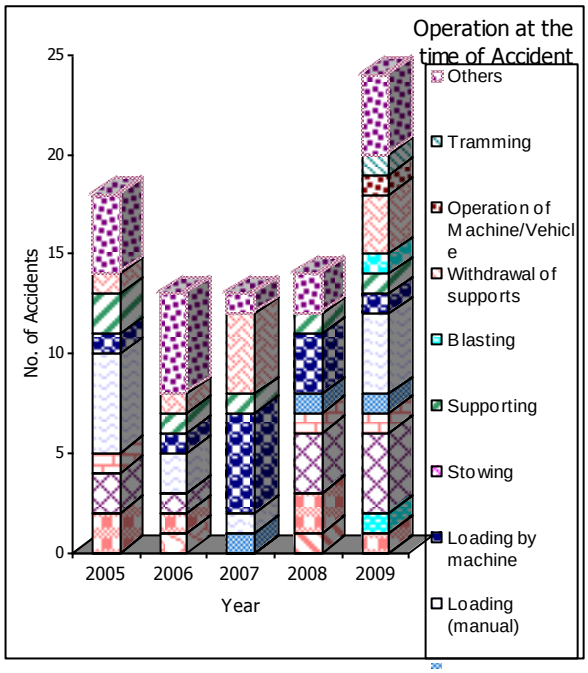
* Provisional

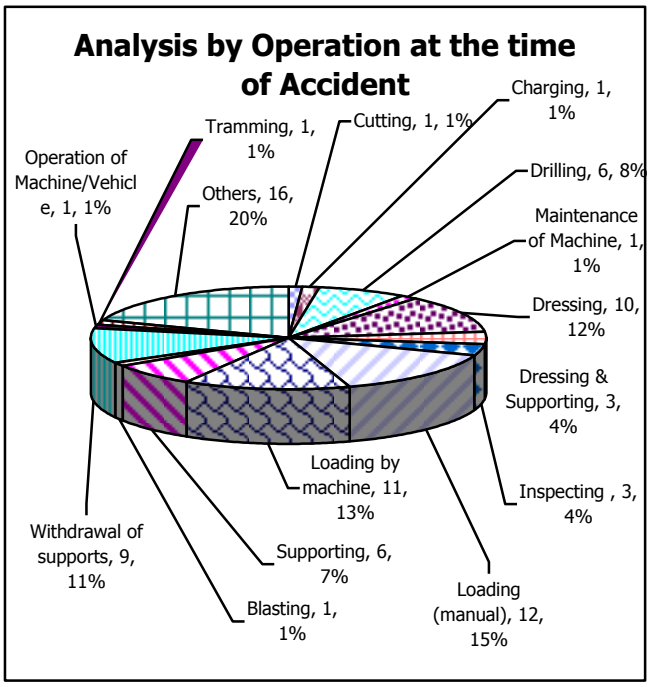




7. Distribution of fatal roof fall accidents by operation at the time of accident

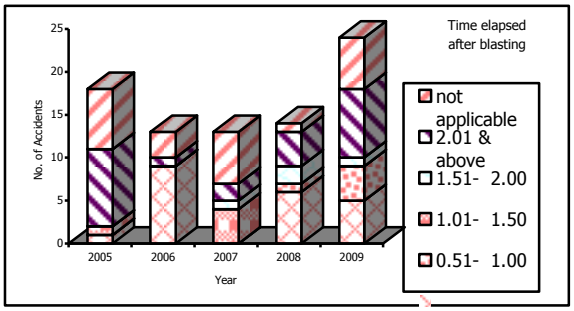
operation at the time of accident	Number of accidents											
	2005	%	2006	%	2007	%	2008	%	2009	%	total	%
Cutting	0	0	1	8	0	0	0	0	0	0	1	1
Charging	0	0	0	0	0	0	1	7	0	0	1	1
Drilling	2	11	1	8	0	0	2	14	1	4	6	8
Maintenance of Machine	0	0	0	0	0	0	0	0	1	4	1	1
Dressing	2	11	1	8	0	0	3	22	4	17	10	12
Dressing & Supporting	1	6	0	0	0	0	1	7	1	4	3	4
Inspecting	0	0	0	0	1	8	1	7	1	4	3	4
Loading (manual)	5	27	2	15	1	8	0	0	4	17	12	15
Loading by machine	1	6	1	8	5	38	3	22	1	4	11	13
Stowing	0	0	0	0	0	0	0	0	0	0	0	0
Supporting	2	11	1	8	1	8	1	7	1	4	6	7
Blasting	0	0	0	0	0	0	0	0	1	4	1	1
Withdrawal of supports	1	6	1	8	4	30	0	0	3	13	9	11
Operation of Machine/Vehicle	0	0	0	0	0	0	0	0	1	4	1	1
Tramming	0	0	0	0	0	0	0	0	1	4	1	1
Others	4	22	5	37	1	8	2	14	4	17	16	20
Total	**18**	**100**	**13**	**100**	**13**	**100**	**14**	**100**	**24**	**100**	**82**	**100**

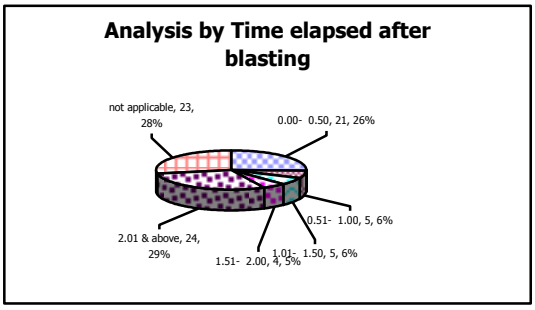




8. Distribution of fatal roof fall accidents by time elapsed after blasting

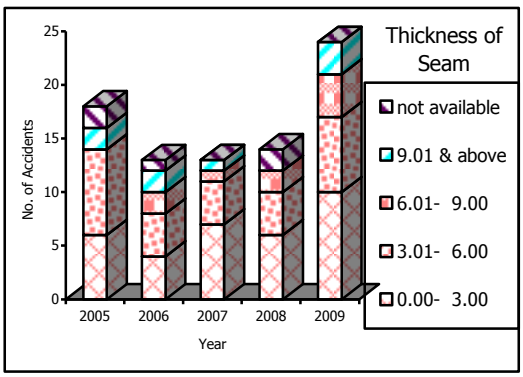
time elapsed after blasting (hours)	Number of accidents											
	2005	%	2006	%	2007	%	2008	%	2009	%	total	%
0.00- 0.50	1	6	9	69	0	0	6	43	5	21	**21**	26
0.51- 1.00	0	0	0	0	0	0	1	7	4	17	**5**	6
1.01- 1.50	1	6	0	0	4	31	0	0	0	0	**5**	6
1.51- 2.00	0	0	0	0	1	8	2	14	1	4	**4**	5
2.01 & above	9	50	1	8	2	15	4	29	8	33	**24**	29
not applicable	7	38	3	23	6	46	1	7	6	25	**23**	28
Total	**18**	**100**	**13**	100	**13**	100	**14**	100	**24**	100	**82**	**100**

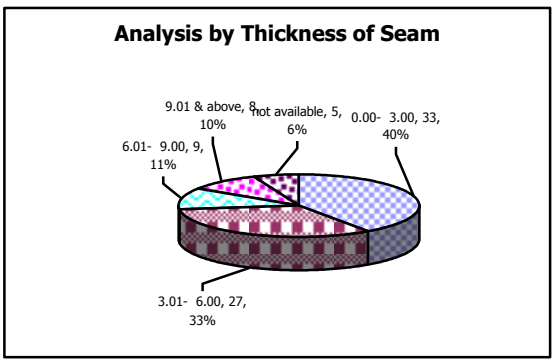




9. Distribution of fatal roof fall accidents by thickness of seam

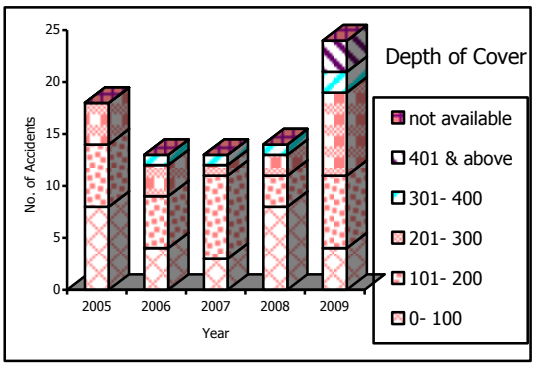
Seam thickness (metres)	Number of accidents											
	2005	%	2006	%	2007	%	2008	%	2009	%	total	%
0.00- 3.00	6	33	4	31	7	54	6	43	10	42	**33**	40
3.01- 6.00	8	45	4	31	4	30	4	29	7	29	**27**	33
6.01- 9.00	0	0	2	15	1	8	2	14	4	17	**9**	11
9.01 & above	2	11	2	15	1	8	0	0	3	12	**8**	10
not available	2	11	1	8	0	0	2	14	0	0	**5**	6
Total	**18**	**100**	**13**	**100**	**13**	**100**	**14**	**100**	**24**	**100**	**82**	**100**

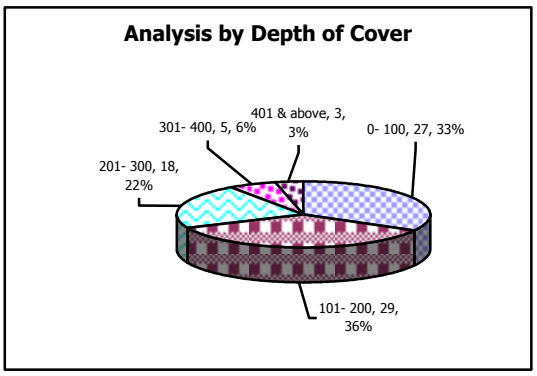




10. Distribution of fatal roof fall accidents by depth of cover

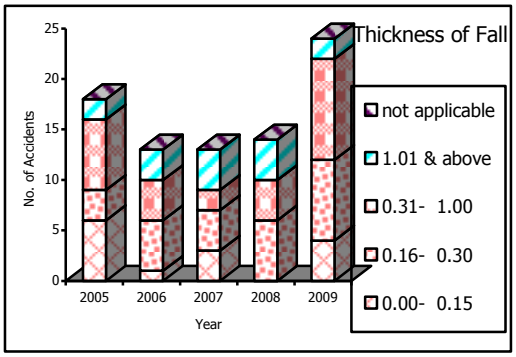
Depth of cover (metres)	Number of accidents											
	2005	%	2006	%	2007	%	2008	%	2009	%	total	%
0- 100	8	45	4	31	3	23	8	57	4	17	**27**	33
101- 200	6	33	5	38	8	61	3	22	7	29	**29**	36
201- 300	4	22	3	23	1	8	2	14	8	33	**18**	22
301- 400	0	0	1	8	1	8	1	7	2	8	**5**	6
401 & above	0	0	0	0	0	0	0	0	3	13	**3**	3
not available	0	0	0	0	0	0	0	0	0	0	**0**	0
Total	**18**	**100**	**13**	**100**	**13**	**100**	**14**	**100**	**24**	**100**	**82**	**100**

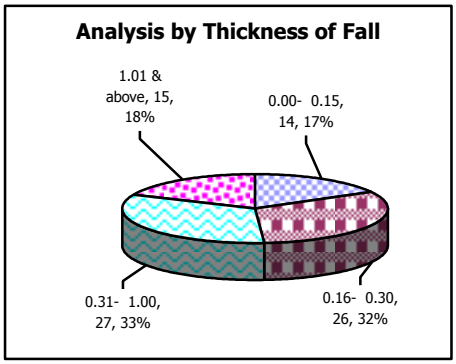




11. Distribution of fatal roof fall accidents by thickness of fall

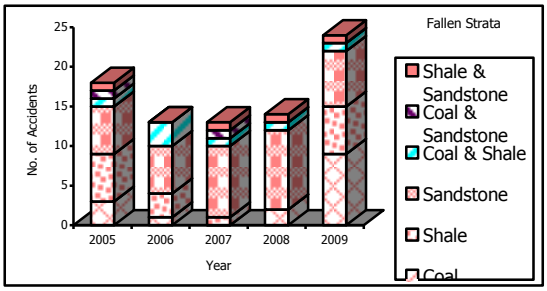
Thickness of fall (metres)	Number of accidents											
	2005	%	2006	%	2007	%	2008	%	2009	%	total	%
0.00- 0.15	6	33	1	8	3	23	0	0	4	17	**14**	17
0.16- 0.30	3	17	5	38	4	31	6	42	8	33	**26**	32
0.31- 1.00	7	39	4	31	2	15	4	29	10	42	**27**	33
1.01 & above	2	11	3	23	4	31	4	29	2	8	**15**	18
Not applicable	0	0	0	0	0	0	0	0	0	0	**0**	0
Total	**18**	**100**	**13**	**100**	**13**	**100**	**14**	**100**	**24**	**100**	**82**	**100**

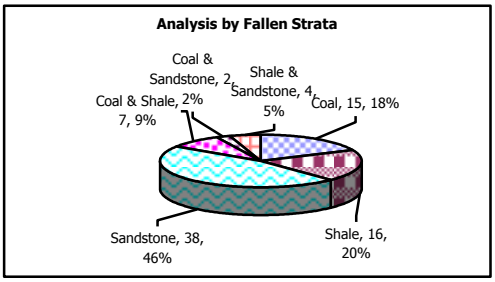




12. Distribution of fatal roof fall accidents by nature of fallen strata

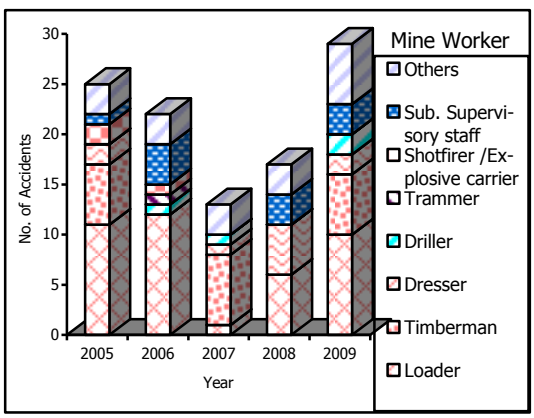
Nature of fallen strata	Number of accidents											
	2005	%	2006	%	2007	%	2008	%	2009	%	total	%
Coal	3	16	1	8	0	0	2	14	9	38	**15**	18
Shale	6	33	3	23	1	8	0	0	6	25	**16**	20
Sandstone	6	33	6	46	9	68	10	72	7	29	**38**	46
Coal & Shale	1	6	3	23	1	8	1	7	1	4	**7**	9
Coal & Sandstone	1	6	0	0	1	8	0	0	0	0	**2**	2
Shale & Sandstone	1	6	0	0	1	8	1	7	1	4	**4**	5
Total	**18**	**100**	**13**	100	**13**	100	**14**	**100**	**24**	**100**	**82**	**100**

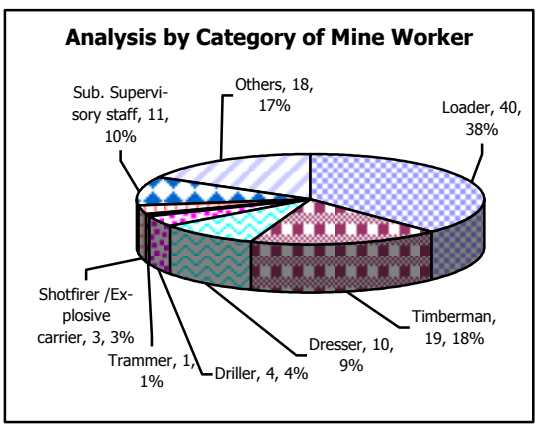




13. Distribution of persons killed in roof fall accidents by designation

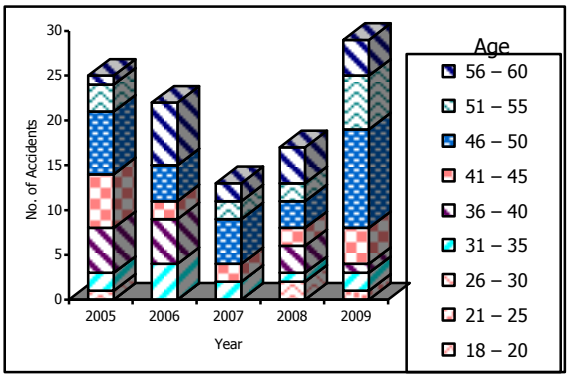
Category of mine worker	Number of persons killed											
	2005	%	2006	%	2007	%	2008	%	2009	%	total	%
Loader	11	44	12	54	1	8	6	35	10	34	**40**	38
Timberman	6	24	0	0	7	53	0	0	6	21	**19**	18
Dresser	2	8	0	0	1	8	5	29	2	7	**10**	9
Driller	0	0	1	5	1	8	0	0	2	7	**4**	4
Trammer	0	0	1	5	0	0	0	0	0	0	**1**	1
Shotfirer /Explosive carrier	2	8	1	5	0	0	0	0	0	0	**3**	3
Sub. Supervisory staff	1	4	4	18	0	0	3	18	3	10	**11**	10
Others	3	12	3	13	3	23	3	18	6	21	**18**	17
Total	**25**	**100**	**22**	**100**	**13**	**100**	**17**	**100**	**29**	**100**	**106**	**100**

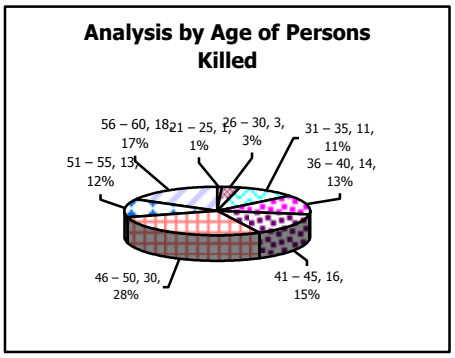




14. Distribution of persons killed in roof fall accidents by age

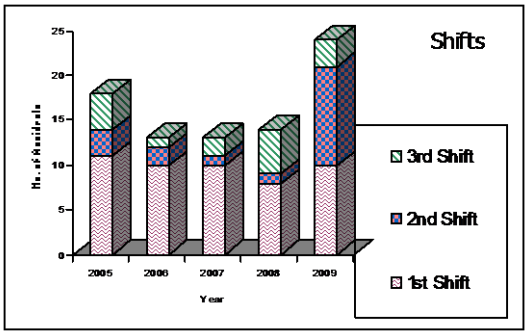
age	Number of persons killed											
	2005	%	2006	%	2007	%	2008	%	2009	%	total	%
18 – 20	0	0	0	0	0	0	0	0	0	0	**0**	0
21 – 25	0	0	0	0	0	0	0	0	1	3	**1**	1
26 – 30	1	4	0	0	0	0	2	12	0	0	**3**	3
31 – 35	2	8	4	18	2	15	1	6	2	7	**11**	11
36 – 40	5	20	5	23	0	0	3	18	1	3	**14**	13
41 – 45	6	24	2	9	2	15	2	12	4	14	**16**	15
46 – 50	7	28	4	18	5	40	3	18	11	38	**30**	28
51 – 55	3	12	0	0	2	15	2	12	6	21	**13**	12
56 – 60	1	4	7	32	2	15	4	22	4	14	**18**	17
Total	**25**	**100**	**22**	**100**	**13**	**100**	**17**	**100**	**29**	**100**	**106**	**100**

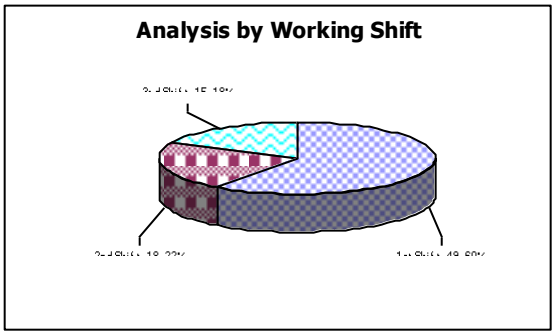




15. Distribution of fatal roof fall accidents by shift during which accident occurred

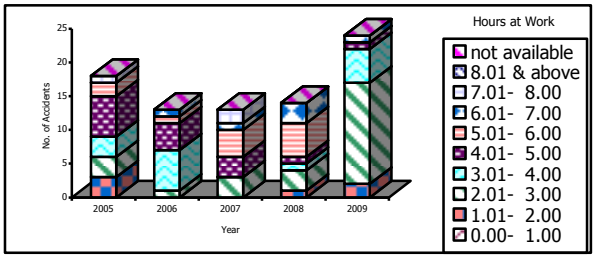
Shift	Number of accidents											
	2005	%	2006	%	2007	%	2008	%	2009	%	total	%
1st (7/8 AM to 3/4 PM)	11	61	10	77	10	77	8	57	10	42	**49**	60
2nd 3/4 PM to 11/12 M	3	17	2	15	1	8	1	7	11	46	**18**	22
3rd 11/12M to 7/8 AM	4	22	1	8	2	15	5	36	3	12	**15**	18
Total	**18**	**100**	**13**	**100**	**13**	**100**	**14**	**100**	**24**	**100**	**82**	**100**

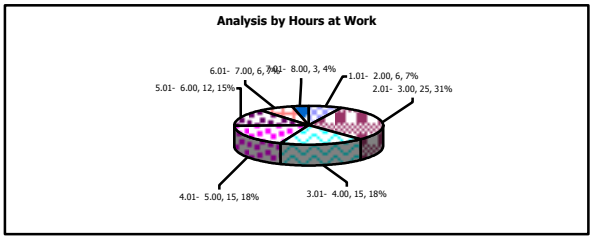




16. Distribution of fatal roof fall accidents by hours spent at work prior to the accident

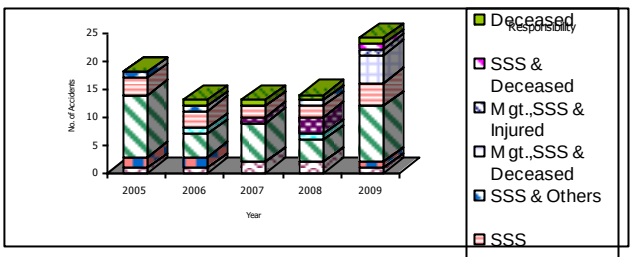
Hours at Work	Number of accidents											
	2005	%	2006	%	2007	%	2008	%	2009	%	total	%
0.00- 1.00	0	0	0	0	0	0	0	0	0	0	**0**	0
1.01- 2.00	3	17	0	0	0	0	1	7	2	8	**6**	7
2.01- 3.00	3	17	1	8	3	23	3	21	15	63	**25**	31
3.01- 4.00	3	17	6	46	0	0	1	7	5	21	**15**	18
4.01- 5.00	6	32	4	30	3	23	1	7	1	4	**15**	18
5.01- 6.00	2	11	1	8	4	31	5	37	0	0	**12**	15
6.01- 7.00	0	0	1	8	1	8	3	21	1	4	**6**	7
7.01- 8.00	1	6	0	0	2	15	0	0	0	0	**3**	4
8.01 & above	0	0	0	0	0	0	0	0	0	0	**0**	0
not available	0	0	0	0	0	0	0	0	0	0	**0**	0
Total	**18**	**100**	**13**	**100**	**13**	**100**	**14**	**100**	**24**	**100**	**82**	**100**

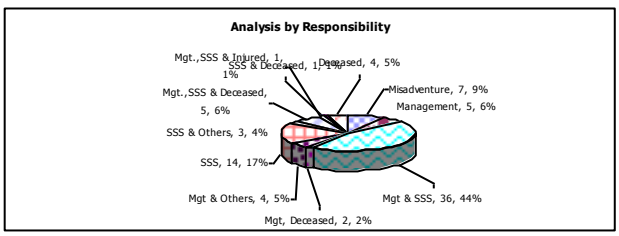




17. Distribution of fatal roof fall accidents by responsibility

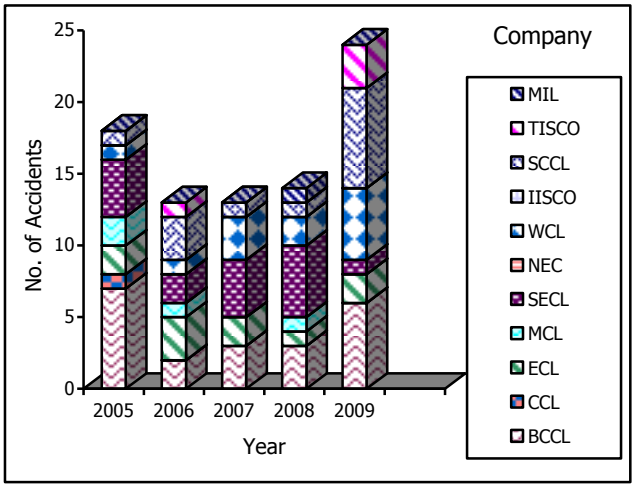
Responsibility	Number of persons											
	2005	%	2006	%	2007	%	2008	%	2009	%	total	%
Misadventure	1	6	1	8	2	15	2	14	1	4	**7**	9
Management	2	11	2	15	0	0	0	0	1	4	**5**	6
Mgt & SSS	11	61	4	30	7	54	4	29	10	42	**36**	44
Mgt, Deceased	0	0	1	8	0	0	1	7	0	0	**2**	2
Mgt & Others	0	0	0	0	1	8	3	22	0	0	**4**	5
SSS	3	16	3	23	2	15	2	14	4	17	**14**	17
SSS & Others	1	6	1	8	0	0	1	7	0	0	**3**	4
Mgt.,SSS & Deceased	0	0	0	0	0	0	0	0	5	21	**5**	6
Mgt.,SSS & Injured	0	0	0	0	0	0	0	0	1	4	**1**	1
SSS & Deceased	0	0	0	0	0	0	0	0	1	4	**1**	1
Deceased	0	0	1	8	1	8	1	7	1	4	**4**	5
Total	**18**	**100**	**13**	**100**	**13**	**100**	**14**	**100**	**24**	**100**	**82**	**100**

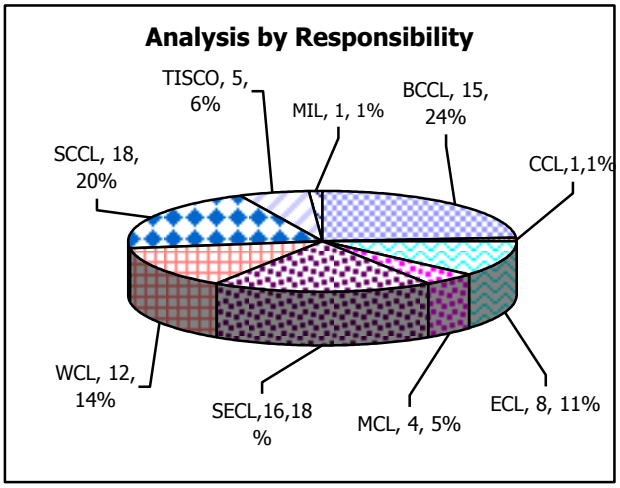




18. Distribution of fatal roof fall accidents by company

Company	Number of accidents											
	2005	%	2006	%	2007	%	2008	%	2009	%	total	%
BCCL	7	38	2	15	3	23	3	22	6	25	**21**	24
CCL	1	6	0	0	0	0	0	0	0	0	**1**	1
ECL	2	11	3	23	2	15	1	7	2	8	**10**	11
MCL	2	11	1	8	0	0	1	7	0	0	**4**	5
SECL	4	22	2	15	4	31	5	36	1	4	**16**	18
NEC	0	0	0	0	0	0	0	0	0	0	**0**	0
WCL	1	6	1	8	3	23	2	14	5	21	**12**	14
CIL: total	**17**	**94**	**9**	**69**	**12**	**92**	**12**	**86**	**14**	58	**64**	73
IISCO	0	0	0	0	0	0	0	0	0	0	**0**	0
SCCL	1	6	3	23	1	8	1	7	7	29	**18**	20
TISCO	0	0	1	8	0	0	0	0	3	13	**5**	6
MIL	0	**0**	0	**0**	0	**0**	1	7	0	0	**1**	1
All-India	**18**	**100**	**13**	**100**	**13**	**100**	**14**	**100**	**24**	**100**	**88**	**100**





2.2.3B.3 Side fall and over hangs

There were 7 (8.43%) fatal accidents involving 8 fatalities due to fall of sides. Six accidents took place in belowground workings and one in opencast.

- Accident due to fall of sides accounted for 8.43% of all fatal accidents in coal mines and 15.38% of all accidents in belowground workings.

2.2.3B.4 Air blast

There was no accident due to this cause during the year 2009.

2.2.3C Transportation machinery (Winding)

There was no fatal accident reported due to transportation machinery (Winding) during the year 2009.

2.2.3D Transportation machinery (Other than winding)

There were 31 fatal accidents due to transportation machinery other than winding reported during the year 2009. A detailed break–up of fatalities under this category are given in the table below:-

TABLE - 23	**FATAL ACCIDENTS DUE TO TRANSPORTATION MACHINERY OTHER THAN WINDING IN SHAFTS IN COAL MINES DURING 2009**	
Cause	**No. of fatal accidents**	**Persons killed**
1. Rope Haulage	5	5
2. Mechanical Conveyors	3	3
3. Dumpers/Tippers	13	13
4. Wheeled Trackless(Truck,Tanker etc.)	9	9
5. Others (Wagon)	1	1
Total	**31**	**31**

It was seen that the dumpers, rope haulages, tanker/truck and belt conveyors were major contributing causes under fatalities due to transportation machinery other than winding.

2.2.3D.1 Rope Haulages

There were 5 accidents (16.2% of all accidents) caused due to rope haulages during the year 2009. Analysis of causes revealed that:-

- Two accidents were occurred due to hit by moving tubs.
- One accident occurred as while traveling slipped and hit by tub.
- Two accidents occurred due to person trapped between tub and pillar.

2.2.3D.2 Mechanical / Belt Conveyors:

Three accidents (99% of all accidents) resulting in three fatalities were caused by belt conveyors during 2009.

- All the three accidents causing death of three persons occurred due to fell in RCC bunker. One person died due to his hand got dragged over running belt and got injury in coal filter. One person died due to lost balance fell down his head got stuck in a moving bottom roller.

2.2.3D.3 Dumpers and tippers:

There were 13 accidents resulting (41.93% of all fatalities) caused due to dumpers and tippers during the year 2009.

The analysis of above accident revealed that:-

- 4 accidents occurred killing persons due to collision of dumpers.
- 6 accidents occurred as speeded dumper run-over persons separately.
- One accident occurred while a dumper hit persons.
- One accident occurred tipper become unbalance and fell down along slop of embankment.
- One accident occurred killing one person due to brake failure.

2.2.3D4 Truck & Tankers:

Nine accident occurred causing nine fatality due to truck and tankers contributing (28.7%) of total accidents.

- One accident due to motorcycle come under truck.
- Three accidents due to truck/tanker hit.
- Two accidents due to ran over of truck/tanker
- Two accident due to roll back of truck/tanker
- One accident due to lost control of vehicle.

2.2.3E Machinery other than transportation machinery:

There were 14 accidents reported during the year 2009, which were caused due to machinery other than transportation machinery. The analysis of the causes revealed that:-

Table – 24	**FATAL ACCIDENTS IN COAL MINES DUE TO MACHINERY OTHER THAN TRANSPORTATION MACHINERY DURING 2009**	
Sl.No.	**No. of fatal accidents**	**Persons killed**
1. Drilling m/c	1	1
2. Loading m/c SDL	5	5
3. Haulage engine	-	-
4. Shovels/Draglines etc.	1	1
5. Crushing & Screening Plant	-	-
6. Other HEMM	6	6
7. Other Non-Transportation Machinery	1	1
Total :	**14**	**14**

Further analysis of the causes revealed that:-

Drilling machine: One accident occurred as cable man crushed underneath the crawler chain.

Loading machine: Five accidents occurred causing five fatalities due to loading machine contributing (35.71%) of total accident:

- One accident occurred due to ran over of SDL.
- Three accidents occurred due to hit of loading machine.
- One accident occurred due to sudden collapse of bucket of SDL.

Haulage engine: No accident by haulage engine

Shovel & Dragline: One accident occurred causing one fatality due to Shovel and Dragline machine contributing (7.14%) of total accident.

Crushing & Screening Plant: There is no accident due to this cause during the year.

Other Heavy Earth Moving Machineries: Six accidents occurred causing six fatalities due to HEMM contribution (42.8%) of total accident.

- Two persons were run over by a surface minor and excavator.
- Four person hit by HEMM.

Non Transportation Machinery:

One accident occurred causing one fatality due to non transportation machinery contribution (7.14%) of total accident.

- One person killed due to locking ring of tyre hit to helper.

2.2.3F Explosives

There was no fatal accident occurred and there were three serious accidents due to explosives during the year 2009.

2.2.3G Electricity

There were 2 (2.40% of the total) fatal accidents involving two persons and two serious accidents due to electricity during the year 2009.

2.2.3H Accidents due to Dust, Gas & Fire.

During the year 2009, there were 2 (2.40% of the total) fatal accident involving 4 fatalities and one serious were occurred due to this cause.

2.2.3I Falls other than falls of ground

Falls other than fall of ground caused 5 (6% of the total) fatal accidents involving same number of lives during the year 2009.

2.2.3J Other causes

Three cases of fatal accident involving five persons were reported due to miscellaneous causes during the year 2009.

2.2.4 Responsibility

Analysis of accidents as per the persons held responsible for the various causes of accidents during the year 2008 has been indicated in table:25.

TABLE:25	RESPONSIBILITY FOR FATAL ACCIDENTS IN COAL MINES DURING THE YEAR 2009	
SL. NO.	Responsibility	No. of accidents
1.	Misadventure	2
2.	Management	11
3.	Management & Subordinate Supervisory Staff (SSS)	12
4.	Management, SSS, co-worker	1
5.	Management, SSS,Co-worker,deceased	2
6.	Management, SSS, co-worker,deceased,injured	2
7.	Management,SSS,Deceased	6
8.	Management,SSS,Injured	1
9.	Management,Shotfirer,Coworker,Deceased	1
10.	Management,Coworker,Deceased	2
11.	Management, Deceased	2
12.	Subordinate Supervisory Staff(SSS)	7
13.	SSS, Coworker, Deceased	3
14.	SSS, Deceased	5
15.	Coworker	5
16.	Co-worker, Deceased	7
17.	Deceased	12
18.	Others	2
	TOTAL	**83**

It can be seen that in 11 (13%) cases management alone and 12 (14%) cases management along with other subordinate staff were responsible. In 7 (8%) of the cases subordinate supervisory staff alone were found responsible. In 12 (14%) cases deceased alone and in 5 (6%) cases the co-worker alone were responsible. These revelations draw the attention towards better planning and implementation of safety status by the management, strict and disciplined supervision by the subordinate supervisory staff and knowledge based effective training for the workers.

2.3 Dangerous occurrences

30 (Thirty) dangerous occurrences were reported under the Coal Mines Regulations, 1957 during the year 2009.Details of cause of dangerous occurrences are given below in Table: 26

TABLE: 26	DANGEROUS OCCURRENCES IN COAL MINES DURING 2009	
Sl.No.	**Cause**	**No. of cases**
1.	Spontaneous heating belowground	9
2.	Spontaneous heating in opencast working	-
3.	Spontaneous heating at surface	-
4.	Outbreak of fire underground from spontaneous heating	3
5.	Outbreak of fire underground from causes other than spontaneous heating	1
6.	Outbreak of fire in quarries from causes other than spontaneous heating	2
7.	Outbreak of fire in surface from causes other than spontaneous heating/ dumper/machinery fire	2
8.	Premature collapse of workings or failure of pillars/ benches/major roof fall	3
9.	Influx of noxious gases	-
10.	Ignition or occurrence of inflammable gas	2
11.	Over winding of cages etc.	-
12.	Breakage of winding rope	-
13.	Breakdown of winding engine, crank shaft, bearing etc.	-
14.	Breakage, fracture etc of essential parts of machinery or apparatus whereby safety of persons was endangered	-
15.	Irruption of water	2
16.	Subsidence/potholing	2
17.	Explosives	2
18.	Dump slide/Collapse of OB bench	2
19.	Others	-
	TOTAL	**30**

A. Spontaneous Heating

In total 12 (twelve) cases of spontaneous heating were reported and all 12 were in belowground workings. Three of them resulted into blazing fire. There was no incidence of spontaneous heating in opencast workings. There was one case of spontaneous heating inside the caved goaf under shallow cover. There was one case of spontaneous heating due to leakage of air inside sealed off area. There was one case of spontaneous heating as the area was not kept sectionalised and the ventilation was not adequate. There was one case of spontaneous heating due to more loss of coal. There was one case of spontaneous heating due to lag in stowing. There were three cases of blazing due to spontaneous heating.

Contributory factors for spontaneous heating:

The primary contributory factors which lead to spontaneous heating and thereby fires:

- Non-sectionlization / improper sectionlization of old workings.

- Not cleaning the old galleries and return airways off fallen coal and not treating thoroughly with stone dust.
- Sluggish ventilation in old workings and depillaring areas.
- Working the depillaring panel beyond the incubation period.
- Not filling up the surface cracks formed due to subsidence and causing leakage of air into the sealed off areas and old workings.
- Not making and maintaining the isolation stoppings as prescribed.
- Non provision of latest carbon monoxide gas detecting devices.

Corrective measures:

- Rate of extraction has to be made faster by deploying well maintained loading machines and loss of coal in the goaf has to be minimized.
- Isolation and sectionlization stoppings have to be regularly inspected as per statute to detect early stage of spontaneous heating.
- Strengthening of old stoppings.
- Fallen loose coal has to be cleaned off regularly.
- Surface area above the goved out panels shall be filled up to avoid breathing of air.
- All the galleries exposed on the side of entries to the belowground workings in the seam shall be covered effectively to avoid breathing of air through those galleries.
- Rib of coal left as barrier between opencast working and belowground working need to be covered to prevent formation of return circuit through the cracks/fissures developed at the surface.

B. Other Fires

There was a case of fire in dry vegetation extended upto the old tyre stock yard of the excavation workshop. There was a case of fire in shale debris as carbonaceous material dumped in haul road caught fire due to fire in dry vegetation. There was a case of fire in conveyor belt of rapid loading system. There was a case of fire in drill m/c during the break down maintenance in an open cast mine. There was a case of fire in 550v cable due to three phase short circuiting at the cable joint box.

Corrective measures:

- Timely action has to be initiated if active fire is known be existed behind the stoppings.
- Reinforcement of stoppings and cleaning of return airway to prevent choking shall be done.
- Adequate precautions shall be taken as per statute while using flame or electric welding or repairing apparatus belowground as well as in opencast workings.
- Proper code of practice for prevention of fires in HEMM should be framed and implemented.

- Availability of Fire Tender in the mine must be ensured.

C. Premature collapse of workings or failure of pillars/benches

In one case top three benches including the embankment made against a nallah slided (quantity is about 18,000m3). In one case there was a major roof fall in the depillaring area where 'Limited Span Method' was in practice. In another case roof fall occurred where 'Wide Stall' method was in practice.

D. Influx of Noxious Gases

There was no case reported.

E. Ignition or occurrence of inflammable gas

There was one case of ignition of inflammable gas and one case of accumulation of inflammable gas as reported.

F. Irruption of water / Landslide

There were two cases of irruption of water due to pot holing reported.

G. Subsidence / Potholing

There were one case of subsidence due to low cover and one case of pot holing due to shallow depth reported.

2.4 Technical Developments

- During the year 2009, 11.97% of the total production came from underground workings and 88.03% of the total production came from opencast mines. As far as average daily employment was concerned 50% were employed belowground, 21% were employed in opencast workings and the remaining 29% were employed for other surface operations.
- During the 2009, 1320 Excavators, 5324 dumpers capacity varying from 35T to 170T, 920 drills of 50 mm to 250 mm, 40 draglines were used in opencast mines.

TABLE:27	TREND IN USE OF HEAVY EARTH MOVING MACHINERY IN OPENCAST COAL MINES					
Year	Shovels	Draglines	Drills	Dumpers	Others	HP of the machinery
1990	787	41	703	3663	1885	2,711,279
1991	864	41	703	3846	1746	2,972,990
1992	892	47	829	4223	2112	3,227,528
1993	910	44	802	4385	1952	3,409,140
1994	946	43	822	4437	1946	3,448,234
1995	956	42	871	4291	2116	3,639,816
1996	961	59	864	4038	1856	3,436,437
1997	1017	42	913	4399	2177	3,703,276
1998	1106	41	918	4520	2279	3,826,094
1999	1216	49	962	4776	2372	4,058,489
2000	1143	43	969	4602	2333	3,938,986
2001	1172	42	977	4666	2304	3,965,541
2002	1159	41	972	4721	2136	3,864,244
2003	1136	39	1003	4576	2163	4,095,742
2004	1135	45	978	4516	2367	3,995,550
2005	1073	34	922	4553	2085	4,035,171
2006	1088	28	861	4391	2006	3,798,259
2007	1188	33	1023	4634	2569	4,249,869
2008	1247	48	1018	4994	2779	4,479,969
2009*	1320	40	920	5324	2750	4,588,696

*Provisional

(a) Number of machines used in underground coal mines of different coal companies are as follows:

Table-28	Number of machines used in underground coal mines during 2009					
Name of Company	**Road header/ Dint header**	**SDL**	**LHD**	**Continuous Miners**	**Coal haulers**	**Other**
BCCL	4	125	6	0	0	0
ECL	1	128	23	1	0	1
CCL	0	19	6	0	0	0
SECL	0	224	147	2	0	1
WCL	0	82	118	2	2	1
MCL	0	21	36	0	0	0
NECL	0	0	0	0	0	5
TATA	0	34	0	0	0	0
SCCL	6	121	37	2	0	3
SAIL	2	0	0	0	0	2
TOTAL	**13**	**754**	**373**	**7**	**2**	**13**

(b) Number of machines used in opencast coal mines of different coal companies are as follows:

TABLE-29	Number of machines used in opencast mines during 2009															
Name of co.					Dumpers					Excavators				Drills		
	Bucket wheel Excavator	Dragline	Surface Miners	Others	170 T	120 T	85 T	50 T	35 T	>20 cu m	19-10 cu m	9-5 cu m	< 5 cu m	> 250 mm	249-150 mm	< 150 mm
BCCL	0	2	0	0	0	0	0	2	484	0	8	72	79	20	70	34
ECL	0	1	0	0	3	35	21	23	157	5	11	15	27	14	24	6
CCL	0	0	0	0	0	0	126	59	453	1	11	48	61	34	68	13
SECL	0	9	6	0	17	71	84	72	167	1	19	41	19	64	67	6
WCL	0	4	0	169	0	0	0	302	313	0	0	0	150	20	87	0
NCL	0	19	0	325	11	153	412	0	0	6	71	0	26	87	35	3
MCL	0	5	29	234	0	11	73	218	12	0	3	34	26	24	30	4
NECL	0	0	0	0	0	0	0	0	112	0	0	0	26	0	0	7
GMDC	2	2	2	15	0	0	0	21	194	0	0	5	76	0	0	3
NLC	31	0	0	568	0	0	0	0	42	0	0	0	69	27	18	1
TATA	0	0	0	0	0	0	40	44	0	0	6	14	0	0	19	0
SCCL	0	0	0	0	0	89	104	0	259	17	6	0	39	13	34	0
GIPCL	0	0	0	2	0	0	0	18	142	0	0	2	42	0	0	0
JSMDC	0	0	0	0	0	0	0	0	16	0	0	0	4	0	0	2
RSMM	0	0	0	5	0	0	0	0	25	0	0	0	5	0	0	0
SAIL	0	0	0	10	0	0	0	0	43	0	0	0	15	0	0	9
TOTAL	**33**	**42**	**37**	**1328**	**31**	**359**	**860**	**759**	**2419**	**30**	**135**	**231**	**664**	**303**	**452**	**88**

2.5 Occupational Health

Medical Examination by Appellate Medical Board

Initial and periodical medical examination under Rule 29B of the Mines Rules, 1955 are conducted by management and medical re-examination by Appellate Medical Board constituted by Central Government under Rule 29K.

(a) Progress of Medical Examination in Coal Mines:

TABLE: 30	**PROGRESS OF INITIAL & PERIODICAL MEDICAL EXAMINATION DURING 2009 IN COAL MINES**			
Name of Company	Initial Medical Examination		Periodical Medical Exam.	
	Required	Provided	Required	Provided
BCCL	-	868	139117	21176
MCL	-	815	4062	3962
WCL	3748	3748	17825	18041
CCL	725	725	11453	11628
NECL	-	-	489	523
ECL	1062	1062	17720	16260
SECL	62	62	23417	19451
NCL	-	236	3400	3475
SCCL	5579	5579	15352	18335
TATA	47	47	1039	1086
GIPCL	480	480	59	59
NLC	29	29	-	106
GMDC	621	621	359	347
JSMDC	0	0	20	25
RSMM	0	0	0	0
SAIL	6	6	373	335

(b) Cases of Notified Diseases in Coal Mines:

TABLE: 31	**CASES OF NOTIFIED DISEASES IN COAL MINES DURING THE YEAR 2009**	
Mining Companies	Name of Disease	Number of cases
SCCL	Carcinoma Lungs Carcinoma Stomach	10 02
MCL	Pneumoconiosis	04
SAIL	Pneumoconiosis	01

2.6 Vocational Training

Recognizing the need for safety education to enable the mineworkers to prepare them to face the challenges of mining, the Mines Vocational Training Rules were framed in 1966. These rules provide the provision for construction of mine vocational training centers, initial, refresher and special training to mine workers, appointment of training officers, instructors, proper training aids and equipments. It also provides for payment to trainees during the training period. Progress of vocational training in coalmines during the year 2009 was reported to be as follows.

TABLE: 32	PROGRESS OF VOCATIONAL TRAINING IN COAL MINES DURING THE YEAR 2009					
Name of the Company.	No. of VT Centers	Basic Training		Refresher Training		Special Training Provided
		Required	Provided	Required	Provided	
BCCL	13	-	745	9043	9285	2669
MCL	5	-	2939	2525	3012	1487
WCL	12	3898	3898	8745	8409	2270
CCL	14	1363	1363	6420	6400	-
NECL	2	259	276	467	557	108
ECL	21	1222	1222	15509	9267	7075
SECL	25	-	5248	11427	12443	8601
NCL	9	-	4457	-	1914	3853
TATA	2	494	494	1617	1646	471
GIPCL	1	753	753	18	18	-
NLC	1	2418	2418	2144	1790	572
SCCL	8	4476	4476	10865	10910	4934
GMDC	3	1025	1025	196	119	175
JSMDC	1	4	4	25	29	5
RSMM	1	30	30	-	-	-
SAIL	2	390	390	495	478	426

2.7 Workmen's Inspector, Safety Committee & Welfare Officers

Much greater strides in safety can be achieved by participation of workmen in safety programme, the twin institutions of 'Safety Committee & 'Workmen's Inspector' have been conceived and given the statutory backing. DGMS is also associated with training of Workmen's Inspectors to make them effective in discharge of their duties. In coal mines almost all the eligible mines had Workmen's Inspector and Safety Committee. The table below shows the status of appointment of Welfare Officer, Workmen's Inspector and formation of Safety Committees during the year 2009.

TABLE: 33	**NUMBER OF WORKMEN'S INSPECTOR IN POSITION, SAFETY COMMITTEE, WELFARE OFFICERS IN COAL MINES DURING 2009**					
Name of Company	Welfare Officers		Workmen Inspectors		Safety Committee	
	Required	Provided	Required	Provided	Required	Provided
BCCL	64	64	192	199	64	64
MCL	22	22	88	88	22	22
WCL	75	75	225	225	77	77
CCL	48	46	181	180	60	60
NECL	5	5	15	15	5	5
ECL	89	65	266	297	99	101
SECL	91	91	273	273	91	91
NCL	12	12	31	32	10	10
TATA	8	8	44	44	12	12
GIPCL	3	3	1	1	1	1
NLC	4	4	20	22	11	11
SCCL	50	50	227	227	446	446
GMDC	7	7	9	9	4	4
JSMDC	0	0	2	2	1	1
RSMM	1	0	3	3	1	1
SAIL	3	3	9	9	3	3

2.8 Owner-wise consolidated fatal accident statistics for last 8(Eight) years in coal mines

Owner	Year	Fatal Accidents								Death Rate per 1000 persons employed			
		Belowground		Opencast		Aboveground		Total					
		Accident	Killed	Accident	Killed	Accident	Killed	Accident	Killed	BG	OC	AG	Total
BCCL	2002	4	5	3	3	3	3	10	11	0.14	0.25	0.14	0.16
	2003	7	8	2	2	3	3	12	13	0.23	0.17	0.14	0.19
	2004	7	8	3	3	1	1	11	12	0.25	0.31	0.05	0.20
	2005	10	15	1	1	3	3	14	19	0.50	0.10	0.17	0.33
	2006	7	56	5	5	0	0	12	61	1.98	0.55	0.00	1.14
	2007	4	4	3	3	2	2	9	9	0.15	0.35	0.13	0.18
	2008	8	8	2	2	1	1	11	11	0.32	0.25	0.07	0.23
	2009	6	8	4	6	4	4	14	18	0.32	0.75	0.29	0.38
CCL	2002	3	3	7	7	1	1	11	11	0.21	0.50	0.06	0.24
	2003	3	3	2	2	1	1	6	6	0.21	0.14	0.06	0.13
	2004	5	5	5	5	0	0	10	10	0.37	0.41	0.00	0.24
	2005	3	16	4	5	0	0	7	21	1.21	0.43	0.00	0.52
	2006	2	2	1	1	2	2	5	5	0.17	0.08	0.13	0.13
	2007	0	0	4	5	3	3	7	8	0.00	0.39	0.21	0.21
	2008	0	0	2	2	2	2	4	4	0.00	0.17	0.14	0.11
	2009	1	1	3	3	2	2	6	6	0.10	0.26	0.14	0.17
ECL	2002	5	5	3	3	1	4	9	12	0.10	0.74	0.14	0.14
	2003	10	10	3	3	0	0	13	13	0.20	0.74	0.00	0.16
	2004	10	11	5	5	1	1	16	17	0.24	1.09	0.04	0.22
	2005	9	10	3	3	4	4	16	17	0.22	0.62	0.15	0.22
	2006	7	12	1	1	0	0	8	13	0.28	0.16	0.00	0.18
	2007	5	5	2	3	0	0	7	8	0.12	0.47	0.00	0.11
	2008	5	5	2	2	4	4	11	11	0.12	0.35	0.18	0.16
	2009	6	7	2	2	0	0	8	9	0.17	0.35	0.00	0.13
MCL	2002	1	1	2	2	0	0	3	3	0.21	0.41	0.00	0.18
	2003	0	0	6	6	1	1	7	7	0.00	1.24	0.15	0.43
	2004	2	2	2	2	0	0	4	4	0.39	0.39	0.00	0.23
	2005	3	3	4	4	3	3	10	10	0.67	0.60	0.50	0.58
	2006	1	1	1	1	0	0	2	2	0.24	0.16	0.00	0.12
	2007	0	0	3	3	1	1	4	4	0.00	0.48	0.17	0.24
	2008	1	1	2	2	1	1	4	4	0.25	0.30	0.18	0.25
	2009	0	0	1	1	2	2	3	3	0.00	0.15	0.37	0.19
NCL	2002	0	0	1	1	0	0	1	1	0.00	0.16	0.00	0.08
	2003	0	0	1	1	1	1	2	2	0.00	0.16	0.15	0.15
	2004	0	0	3	4	0	0	3	4	0.00	0.59	0.00	0.31
	2005	0	0	1	1	2	2	3	3	0.00	0.15	0.31	0.22
	2006	0	0	3	4	1	1	4	5	0.00	0.53	0.16	0.36
	2007	0	0	4	4	2	2	6	6	0.00	0.40	0.33	0.37
	2008	0	0	5	9	0	0	5	9	0.00	0.84	0.00	0.54

Owner	Year	Fatal Accidents								Death Rate per 1000 persons employed			
		Belowground		Opencast		Aboveground		Total					
		Accident	Killed	Accident	Killed	Accident	Killed	Accident	Killed	BG	OC	AG	Total
	2009	0	0	4	4	0	0	4	4	0.00	0.37	0.00	0.24
NEC	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	1	1	1	1	0	0	2	2	0.86	1.39	0.00	0.74
	2005	1	1	0	0	0	0	1	1	0.88	0.00	0.00	0.36
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	1	5	1	2	0	0	2	7	4.63	2.80	0.00	2.89
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
SECL	2002	8	11	2	2	3	3	13	16	0.30	0.30	0.19	0.27
	2003	7	7	0	0	4	4	11	11	0.19	0.00	0.25	0.18
	2004	5	6	1	1	1	1	7	8	0.17	0.15	0.06	0.14
	2005	7	8	5	5	2	2	14	15	0.23	0.71	0.13	0.26
	2006	3	3	3	3	1	1	7	7	0.09	0.41	0.06	0.12
	2007	5	5	4	4	5	5	14	14	0.15	0.56	0.36	0.26
	2008	6	7	3	3	2	2	11	12	0.22	0.42	0.15	0.23
	2009	4	4	5	5	0	0	9	9	0.13	0.70	0.00	0.17
WCL	2002	11	11	2	2	2	2	15	15	0.45	0.28	0.12	0.32
	2003	4	4	2	2	3	6	9	12	0.16	0.28	0.37	0.25
	2004	6	6	5	5	2	2	13	13	0.26	0.60	0.13	0.27
	2005	6	6	4	4	1	1	11	11	0.27	0.56	0.07	0.25
	2006	7	7	1	1	5	5	13	13	0.34	0.13	0.34	0.30
	2007	5	5	6	6	1	1	12	12	0.25	0.83	0.07	0.29
	2008	6	8	2	2	3	3	11	13	0.39	0.30	0.22	0.32
	2009	8	9	1	2	2	2	11	13	0.44	0.30	0.14	0.32
CIL	2002	32	36	20	20	10	13	62	69	0.22	0.36	0.11	0.20
	2003	31	32	16	16	13	16	60	64	0.19	0.29	0.14	0.19
	2004	36	39	25	26	5	5	66	70	0.25	0.48	0.05	0.22
	2005	39	59	22	23	15	15	76	97	0.39	0.42	0.14	0.31
	2006	27	81	15	16	9	9	51	106	0.57	0.28	0.09	0.35
	2007	19	19	26	28	14	14	59	61	0.14	0.47	0.15	0.21
	2008	27	34	19	24	13	13	59	71	0.25	0.42	0.14	0.25
	2009	25	29	20	23	10	10	55	62	0.22	0.40	0.11	0.22
JSMDC	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	1	1	0	0	1	1	0.00	7.94	0.00	4.98
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00

Owner	Year	Fatal Accidents								Death Rate per 1000 persons employed			
		Belowground		Opencast		Aboveground		Total					
		Accident	Killed	Accident	Killed	Accident	Killed	Accident	Killed	BG	OC	AG	Total
DVC	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
DVC	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	1	1	0	0	1	1	0.00	9.26	0.00	4.33
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
GMDC	2002	0	0	1	1	0	0	1	1	0.00	1.34	0.00	0.74
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	1	1	0	0	1	1	0.00	1.36	0.00	0.69
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	1	1	1	1	2	2	0.00	1.27	1.47	1.37
	2009	0	0	1	1	0	0	1	1	0.00	1.27	0.00	0.68
IISCO	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	2	2	0	0	2	2	0.00	4.46	0.00	0.63
	2005	1	1	0	0	0	0	1	1	0.59	0.00	0.00	0.32
	2006	2	2	0	0	0	0	2	2	1.18	0.00	0.00	0.64
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
J&K	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
NLC	2002	0	0	1	1	0	0	1	1	0.00	0.26	0.00	0.14
	2003	0	0	1	2	0	0	1	2	0.00	0.51	0.00	0.27
	2004	0	0	2	2	1	1	3	3	0.00	0.32	0.28	0.31
	2005	0	0	1	1	0	0	1	1	0.00	0.20	0.00	0.08
	2006	0	0	5	5	0	0	5	5	0.00	0.63	0.00	0.47
	2007	0	0	2	2	0	0	2	2	0.00	0.25	0.00	0.19
	2008	0	0	2	2	0	0	2	2	0.00	0.31	0.00	0.19
	2009	0	0	2	2	1	1	3	3	0.00	0.31	0.24	0.28
SCCL	2002	13	22	0	0	1	1	14	23	0.45	0.00	0.14	0.37

Owner	Year	Fatal Accidents								Death Rate per 1000 persons employed			
		Belowground		Opencast		Aboveground		Total					
		Accident	Killed	Accident	Killed	Accident	Killed	Accident	Killed	BG	OC	AG	Total
	2003	12	37	6	6	1	1	19	44	0.75	1.01	0.14	0.71
	2004	10	13	1	1	0	0	11	14	0.28	0.17	0.00	0.23
	2005	8	8	2	2	1	1	11	11	0.17	0.37	0.14	0.19
SCCL	2006	13	16	3	3	0	0	16	19	0.36	0.50	0.00	0.33
	2007	4	4	5	5	2	2	11	11	0.10	0.72	0.28	0.20
	2008	4	4	5	6	4	4	13	14	0.09	0.74	0.55	0.24
	2009	11	14	6	6	0	0	17	20	0.33	0.74	0.00	0.35
TISCO	2002	3	3	0	0	0	0	3	3	0.57	0.00	0.00	0.37
	2003	3	3	0	0	0	0	3	3	0.57	0.00	0.00	0.37
	2004	3	5	0	0	0	0	3	5	1.01	0.00	0.00	0.63
	2005	2	2	0	0	0	0	2	2	0.38	0.00	0.00	0.24
	2006	2	3	0	0	1	1	3	4	0.57	0.00	0.60	0.49
	2007	1	1	0	0	0	0	1	1	0.20	0.00	0.00	0.10
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	3	3	0	0	0	0	3	3	0.58	0.00	0.00	0.42
GIPCL	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	1	1	0	0	1	1	0.00	3.95	0.00	2.99
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
BA	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	1	1	0	0	1	1	0.00	27.03	0.00	25.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
JINDAL	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	1	1	1	1	0.00	0.00	0.00	6.41
BLAI	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00

Owner	Year	Fatal Accidents								Death Rate per 1000 persons employed			
		Belowground		Opencast		Aboveground		Total					
		Accident	Killed	Accident	Killed	Accident	Killed	Accident	Killed	BG	OC	AG	Total
	2004	0	0	1	1	0	0	1	1	0.00	10.87	0.00	5.71
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
BLAI	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
ICML	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	1	1	0	0	1	1	0.00	1.59	0.00	1.12
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
MIL	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	2	2	2	2	0.00	0.00	33.90	6.62
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	1	1	0	0	0	0	1	1	1.02	0.00	0.00	0.97
	2008	1	1	0	0	0	0	1	1	0.70	0.00	0.00	0.61
	2009	0	0	0	0	1	1	1	1	0.00	0.00	4.52	0.61
JNL	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	1	1	1	1	0.00	0.00	43.48	5.81
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
KECML	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	1	1	0	0	1	1	0.00	3.42	0.00	3.18
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
JPL	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00

Owner	Year	Fatal Accidents								Death Rate per 1000 persons employed			
		Belowground		Opencast		Aboveground		Total					
		Accident	Killed	Accident	Killed	Accident	Killed	Accident	Killed	BG	OC	AG	Total
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	1	1	1	1	0.00	0.00	2.48	0.54
ALL INDIA	2002	48	61	22	22	11	14	81	97	0.27	0.32	0.11	0.23
	2003	46	72	23	24	14	17	83	113	0.32	0.35	0.13	0.27
	2004	49	57	32	33	6	6	87	96	0.27	0.47	0.05	0.24
	2005	50	70	28	29	18	18	96	117	0.34	0.42	0.15	0.29
	2006	44	102	24	25	10	10	78	137	0.52	0.33	0.09	0.36
	2007	25	25	35	37	16	16	76	78	0.13	0.46	0.14	0.21
	2008	32	39	29	35	19	19	80	93	0.21	0.45	0.18	0.25
	2009	39	46	29	32	15	15	83	93	0.25	0.41	0.14	0.25

BG- Belowground OC-Opencast AG-Aboveground
Note : Figures for the year 2009 are provisional.

2.9 Owner-wise consolidated serious accident statistics for last 8 (eight) years in coal mines

Owner	Year	Serious Accidents								S/Injury Rate per 1000 persons employed			
		Belowground		Opencast		Aboveground		Total					
		Accident	S/Inj	Accident	S/Inj	Accident	S/Inj	Accident	S/Inj	BG	OC	AG	Total
BCCL	2002	44	56	16	17	8	8	68	81	1.60	1.44	0.37	1.18
	2003	39	42	9	9	12	12	60	63	1.20	0.76	0.56	0.92
	2004	58	60	8	8	11	11	77	79	1.89	0.84	0.60	1.32
	2005	20	31	11	11	10	12	41	54	1.03	1.15	0.69	0.95
	2006	19	20	11	13	4	4	34	37	0.71	1.44	0.25	0.69
	2007	36	37	14	14	9	9	59	60	1.38	1.64	0.57	1.17
	2008	28	28	7	7	13	13	48	48	1.11	0.88	0.93	1.02
	2009	20	21	12	14	9	9	41	44	0.84	1.75	0.64	0.93
CCL	2002	9	9	9	11	8	8	26	28	0.62	0.78	0.47	0.61
	2003	11	11	7	9	9	9	27	29	0.75	0.64	0.53	0.63
	2004	15	18	7	9	5	5	27	32	1.34	0.75	0.32	0.78
	2005	7	7	11	11	7	7	25	25	0.53	0.95	0.44	0.62
	2006	8	8	8	8	3	3	19	19	0.70	0.65	0.20	0.49
	2007	10	10	7	7	4	5	21	22	0.85	0.55	0.35	0.57
	2008	8	8	5	5	5	6	18	19	0.83	0.43	0.43	0.54
	2009	1	1	1	1	4	6	6	8	0.10	0.09	0.43	0.23
ECL	2002	161	162	6	6	24	24	191	192	3.26	1.47	0.81	2.30
	2003	141	147	9	11	21	21	171	179	2.96	2.70	0.71	2.15
	2004	148	151	14	15	24	24	186	190	3.25	3.28	0.86	2.41
	2005	54	56	7	7	14	14	75	77	1.24	1.44	0.51	1.00
	2006	83	86	5	5	9	9	97	100	2.02	0.81	0.36	1.36
	2007	95	107	8	8	17	17	120	132	2.59	1.24	0.70	1.83
	2008	85	86	8	8	19	19	112	113	2.04	1.40	0.85	1.61
	2009	82	84	9	9	19	19	110	112	1.99	1.58	0.85	1.60
MCL	2002	9	9	6	6	2	2	17	17	1.86	1.24	0.30	1.04
	2003	5	5	4	4	3	3	12	12	1.03	0.83	0.45	0.74
	2004	5	5	7	7	5	5	17	17	0.96	1.36	0.68	0.96
	2005	6	6	5	5	3	3	14	14	1.34	0.75	0.50	0.81
	2006	6	6	3	11	3	3	12	20	1.44	1.76	0.53	1.24
	2007	4	4	4	4	0	0	8	8	0.94	0.64	0.00	0.49
	2008	1	1	2	2	2	2	5	5	0.25	0.30	0.37	0.31
	2009	4	4	2	2	0	0	6	6	0.99	0.30	0.00	0.37
NCL	2002	0	0	5	5	4	4	9	9	0.00	0.80	0.59	0.69
	2003	0	0	11	11	7	7	18	18	0.00	1.76	1.04	1.39
	2004	0	0	5	5	4	5	9	10	0.00	0.74	0.81	0.77
	2005	0	0	10	11	3	3	13	14	0.00	1.61	0.46	1.05
	2006	0	0	7	7	6	6	13	13	0.00	0.93	0.95	0.94
	2007	0	0	10	10	2	3	12	13	0.00	1.00	0.50	0.81
	2008	0	0	7	7	1	1	8	8	0.00	0.66	0.16	0.48
	2009	0	0	2	2	0	0	2	2	0.00	0.19	0.00	0.12
NEC	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	1	1	0	0	0	0	1	1	0.86	0.00	0.00	0.37

Owner	Year	Serious Accidents								S/Injury Rate per 1000 persons employed			
		Belowground		Opencast		Aboveground		Total					
		Accident	S/Inj	Accident	S/Inj	Accident	S/Inj	Accident	S/Inj	BG	OC	AG	Total
	2005	0	1	0	0	0	0	0	1	0.88	0.00	0.00	0.36
NEC	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	14	0	0	0	0	0	14	12.96	0.00	0.00	5.78
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
SECL	2002	78	84	16	18	17	17	111	119	2.26	2.71	1.06	1.99
	2003	64	67	12	13	16	16	92	96	1.80	1.96	1.00	1.60
	2004	73	74	13	13	22	22	108	109	2.05	2.00	1.35	1.85
	2005	68	72	9	9	18	19	95	100	2.06	1.28	1.20	1.73
	2006	53	56	10	10	6	6	69	72	1.62	1.37	0.38	1.25
	2007	48	49	8	11	15	15	71	75	1.49	1.55	1.07	1.39
	2008	43	43	6	7	5	5	54	55	1.35	0.98	0.36	1.04
	2009	38	42	1	2	7	7	46	51	1.32	0.28	0.51	0.97
WCL	2002	36	38	11	12	13	13	60	63	1.56	1.69	0.81	1.32
	2003	41	43	13	13	13	14	67	70	1.77	1.83	0.87	1.47
	2004	38	41	11	12	17	17	66	70	1.79	1.43	1.06	1.48
	2005	30	31	6	7	5	5	41	43	1.40	0.98	0.34	0.98
	2006	29	32	7	8	10	10	46	50	1.54	1.06	0.68	1.16
	2007	37	37	10	11	6	6	53	54	1.84	1.53	0.43	1.31
	2008	17	17	8	8	4	4	29	29	0.84	1.20	0.29	0.71
	2009	29	30	3	3	6	6	38	39	1.48	0.45	0.43	0.95
CIL	2002	337	358	69	75	76	76	482	509	2.14	1.35	0.66	1.51
	2003	301	315	65	70	81	82	447	467	1.88	1.26	0.71	1.38
	2004	338	350	65	69	88	89	491	508	2.23	1.28	0.82	1.59
	2005	185	204	59	61	60	63	304	328	1.35	1.12	0.60	1.06
	2006	198	208	51	62	41	41	290	311	1.46	1.09	0.41	1.04
	2007	230	244	61	65	53	55	344	364	1.77	1.10	0.58	1.25
	2008	182	197	43	44	49	50	274	291	1.47	0.77	0.56	1.03
	2009	174	182	30	33	45	47	249	262	1.36	0.58	0.52	0.93
JSMDC	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
DVC	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	1	1	0	0	1	1	0.00	9.26	0.00	4.33

Owner	Year	Serious Accidents								S/Injury Rate per 1000 persons employed			
		Belowground		Opencast		Aboveground		Total					
		Accident	S/Inj	Accident	S/Inj	Accident	S/Inj	Accident	S/Inj	BG	OC	AG	Total
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
DVC	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
GMDC	2002	0	0	1	1	1	1	2	2	0.00	1.34	1.66	1.48
	2003	0	0	3	3	0	0	3	3	0.00	4.02	0.00	2.22
	2004	0	0	0	0	2	2	2	2	0.00	0.00	3.34	1.60
	2005	0	0	1	1	0	0	1	1	0.00	1.36	0.00	0.69
	2006	0	0	1	1	0	0	1	1	0.00	1.50	0.00	0.74
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
IISCO	2002	9	9	0	0	0	0	9	9	4.47	0.00	0.00	2.72
	2003	9	9	0	0	3	3	12	12	4.47	0.00	3.19	3.62
	2004	15	15	3	3	0	0	18	18	8.85	6.70	0.00	5.69
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	4	5	0	0	3	3	7	8	2.95	0.00	3.13	2.57
	2007	7	7	1	1	1	1	9	9	4.33	1.78	1.09	300.00
	2008	4	4	0	0	0	0	4	4	2.78	0.00	0.00	1.41
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
J&K	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	1	1	0	0	0	0	1	1	1.25	0.00	0.00	0.97
	2004	3	3	0	0	0	0	3	3	3.36	0.00	0.00	2.92
	2005	0	0	0	0	1	3	1	3	0.00	0.00	21.90	3.08
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
NLC	2002	0	0	9	9	2	2	11	11	0.00	2.31	0.59	1.51
	2003	0	0	7	10	1	1	8	11	0.00	2.57	0.29	1.51
	2004	0	0	1	1	2	2	3	3	0.00	0.16	0.56	0.31
	2005	0	0	2	3	0	0	2	3	0.00	0.59	0.00	0.25
	2006	0	0	3	3	1	1	4	4	0.00	0.38	0.38	0.38
	2007	0	0	1	1	0	0	1	1	0.00	0.13	0.00	0.09
	2008	0	0	2	3	0	0	2	3	0.00	0.46	0.00	0.28
	2009	0	0	5	5	3	4	8	9	0.00	0.77	0.98	0.85
SCCL	2002	85	93	12	12	20	20	117	125	1.89	2.01	2.83	2.00
	2003	68	72	7	7	13	13	88	92	1.46	1.17	1.84	1.48
	2004	396	405	12	12	29	30	437	447	8.70	2.04	4.10	7.48
	2005	656	661	35	35	104	104	795	800	14.38	6.47	14.19	13.63
	2006	444	452	32	32	81	81	557	565	10.18	5.31	10.96	9.77

Owner	Year	Serious Accidents								S/Injury Rate per 1000 persons employed			
		Belowground		Opencast		Aboveground		Total					
		Accident	S/Inj	Accident	S/Inj	Accident	S/Inj	Accident	S/Inj	BG	OC	AG	Total
	2007	478	482	20	21	68	71	566	574	11.56	3.02	9.79	10.27
	2008	328	332	26	26	47	47	401	405	7.81	3.20	6.42	6.99
	2009	313	321	15	16	47	47	375	384	7.55	1.97	6.42	6.63
TISCO	2002	3	4	1	1	4	4	8	9	0.76	0.85	2.37	1.11
	2003	1	1	0	0	3	3	4	4	0.19	0.00	1.78	0.49
	2004	5	5	1	1	2	3	8	9	1.01	0.77	1.84	1.14
	2005	2	2	0	0	0	0	2	2	0.38	0.00	0.00	0.24
	2006	0	0	1	1	0	0	1	1	0.00	0.75	0.00	0.12
	2007	2	2	0	0	1	1	3	3	0.40	0.00	0.34	0.31
	2008	2	3	2	2	0	0	4	5	0.58	1.49	0.00	0.70
	2009	1	1	0	0	1	1	2	2	0.19	0.00	1.64	0.28
GIPCL	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	1	1	0	0	1	1	0.00	6.54	0.00	4.78
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
BA	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
JINDAL	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	1	0	1	0.00	0.00	0.00	6.41
BLAI	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00

Owner	Year	Serious Accidents								S/Injury Rate per 1000 persons employed			
		Belowground		Opencast		Aboveground		Total					
		Accident	S/Inj	Accident	S/Inj	Accident	S/Inj	Accident	S/Inj	BG	OC	AG	Total
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
ICML	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
ICML	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
MIL	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	1	1	1	1	0.00	0.00	21.74	0.97
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	1	1	0	0	0	0	1	1	0.70	0.00	0.00	0.61
JNL	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	1	1	0	0	0	0	1	1	166.67	0.00	0.00	5.81
KECML	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
JPL	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00

Owner	Year	Serious Accidents								S/Injury Rate per 1000 persons employed			
		Belowground		Opencast		Aboveground		Total					
		Accident	S/Inj	Accident	S/Inj	Accident	S/Inj	Accident	S/Inj	BG	OC	AG	Total
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
ALL INDIA	2002	434	464	92	98	103	103	629	665	2.07	1.43	0.80	1.57
	2003	380	398	82	90	101	102	563	590	1.77	1.31	0.79	1.40
	2004	757	778	82	87	123	126	962	991	3.69	1.24	1.02	2.45
	2005	843	867	98	101	165	170	1106	1138	4.23	1.45	1.37	2.85
	2006	646	665	88	99	127	127	861	891	3.40	1.30	1.11	2.31
	2007	717	735	83	88	123	128	923	951	3.91	1.10	1.15	2.51
	2008	516	536	74	76	96	97	686	709	2.87	0.98	0.92	1.92
	2009	490	506	50	54	96	100	636	660	2.71	0.70	0.95	1.79

BG- Belowground OC-Opencast AG-Aboveground

Note : Figures for the year 2009 are provisional.
Serious injury includes seriously injured from fatal accidents also.

3.0 Non-Coal Mines

3.1 General

Information presented in the following paragraphs relates to non-coal mines coming under the purview of the Mines Act, 1952.

Estimated numbers of notified working non-coal mines are over about 6000 out of which 1972 non-coal mines including 51 oil mines submitted returns at the end of the year.

Average daily employment in non-coal mines during the year 2009 was 188,644 as compared to 169,230 in 2008. Average daily employment in workings belowground, opencast and aboveground during the year 2009 was 9,542, 102,095 & 77,007 as compared to 9,436, 97,046 & 62,748 respectively during the year 2008. The average daily employment in various minerals is depicted in the table below:

TABLE: 34	Average daily employment and output in non-coal mines during 2009					
Mineral	**No. of Mine Submitted return**	**Average daily employment**				**Output ('000 tonnes)**
		U / G	**O/C**	**Surface**	**Total**	
Bauxite	90	0	5138	790	5928	17800
Copper	5	1710	240	750	2700	3214
Gold	4	1515		1650	3165	699
Granites	196	0	6350	2017	8367	1479
Lime Stone	440	0	22822	6684	29506	287690
Iron-ore	295	0	27268	19906	47174	242169
Manganese	127	2714	7392	4036	14142	3799
Marble	18	0	1070	400	1470	2665
Stone	185	0	5248	2105	7353	32772
Galena & sphalarite	11	1260	480	1690	3430	7373
Others	671	2343	26087	11279	39709	--
Oil & Natural Gas	75	-	-	25700	25700	15438(OILI) 13427(Gas)
Total Non-Coal	**1990**	**9542**	**102095**	**77007**	**188644**	**--**

Note: Figures are provisional
$ Production of Natural Gas (Expressed in Million Cu Meter)

3.2 Accidents

3.2.1 Accidents

There had been decrease in fatal accidents in the year 2009 wherein 43 fatal accidents involving 53 fatalities and 94 serious accidents as compared to 55 fatal accidents involving 76 fatalities and 83 serious accidents during 2008. Table: 35 & 36 given below shows trend in fatal accidents death rates, serious accident & injury rate in non-coal mines.

There was no major accident in Non-coal mines during the year 2009.

TABLE: 35	**TREND IN FATAL ACCIDENTS & DEATH RATES IN NON-COAL MINES**						
Year	Number of accidents			Death rate per 1000 persons employed			
	Fatal	Persons killed	Persons ser. injured	Below ground	Open-cast	Above ground	Overall
1991	84	102	27	0.42	0.45	0.41	0.43
1992	68	78	24	0.52	0.39	0.20	0.33
1993	58	73	9	0.44	0.37	0.22	0.31
1994	61	86	17	1.46	0.32	0.21	0.38
1995	66	74	5	0.35	0.39	0.26	0.33
1996	72	83	14	0.42	0.54	0.23	0.40
1997	70	77	13	0.42	0.47	0.28	0.38
1998	56	65	15	0.33	0.43	0.23	0.33
1999	61	72	13	0.49	0.55	0.19	0.39
2000	51	55	2	0.49	0.37	0.19	0.30
2001	71	81	8	0.52	0.72	0.38	0.55
2002	52	64	3	0.49	0.54	0.21	0.40
2003	52	62	16	0.39	0.46	0.31	0.40
2004	57	64	9	0.62	0.47	0.27	0.41
2005	48	52	4	0.38	0.43	0.17	0.32
2006	58	71	9	0.38	0.62	0.21	0.45
2007	56	64	13	0.35	0.48	0.22	0.37
2008*	55	76	35	0.47	0.47	0.40	0.44
2009*	43	53	7	0.59	0.41	0.13	0.31

* Provisional

Table: 36 indicate trend in serious accidents and serious injury rates in non-coal mines.

TABLE:36	**TREND IN SERIOUS ACCIDENTS AND SERIOUS INJURY RATES IN NON-COAL MINES**					
YEAR	Number of		Serious injury rate per 1000 persons employed			
	Serious accidents	Persons seriously injured	Below ground	Open cast	Above ground	Overall
1991	291	295	5.71	0.40	1.46	1.37
1992	282	285	4.98	0.49	1.40	1.29
1993	315	321	6.06	0.49	1.45	1.42
1994	246	249	5.46	0.39	1.16	1.18
1995	268	274	3.93	0.60	1.45	1.25
1996	263	269	4.78	0.59	1.48	1.35
1997	265	272	5.57	0.42	1.60	1.42
1998	254	258	5.07	0.60	1.52	1.40
1999	230	238	6.16	0.45	1.42	1.37
2000	187	192	4.65	0.46	1.14	1.08
2001	199	200	6.28	0.61	1.57	1.42
2002	205	206	5.06	0.53	1.72	1.31
2003	168	169	7.36	0.43	1.43	1.18
2004	188	194	6.70	0.52	1.59	1.25
2005	108	109	3.41	0.30	0.93	0.71

2006	78	79	3.20	0.25	0.67	0.56
2007	79	92	3.51	0.29	0.70	0.61
2008*	83	85	1.87	0.32	1.10	0.70
2009*	94	101	3.86	0.27	0.73	0.63

* Provisional

Note : Seriously injured from fatal accidents are also considered for computation of serious injury rate.

Table: 37 depicts trend in accidents due to different cause group for the years 2005-2009.

TABLE:37	TREND IN FATAL ACCIDENTS DUE TO DIFFERENT CAUSES IN NON-COAL MINES				
Cause	**2005**	**2006**	**2007**	**2008***	**2009***
Ground movement	6 (7)	9 (17)	9 (16)	14 (23)	15 (23)
Winding in shafts	-	-	-	-	-
Transportation machinery (other than winding)	13 (14)	19 (20)	25 (25)	15 (15)	11 (11)
Machinery other than transportation machinery	9 (10)	5 (5)	7 (7)	4 (6)	4 (4)
Explosive	4 (5)	3 (3)	2 (2)	2 (10)	2 (4)
Electricity	-	-	-	2 (3)	-
Gas, Dust etc.	-	-	-	2 (3)	1 (1)
Falls other than fall of ground	15 (15)	22 (26)	11 (12)	11 (11)	8 (8)
Other causes	1 (1)	-	2 (2)	5 (5)	2 (2)
TOTAL	**48 (52)**	**58 (71)**	**56 (64)**	**55 (76)**	**43 (53)**

Note: Figures in parentheses denote the number of persons killed.
* Figures are provisional

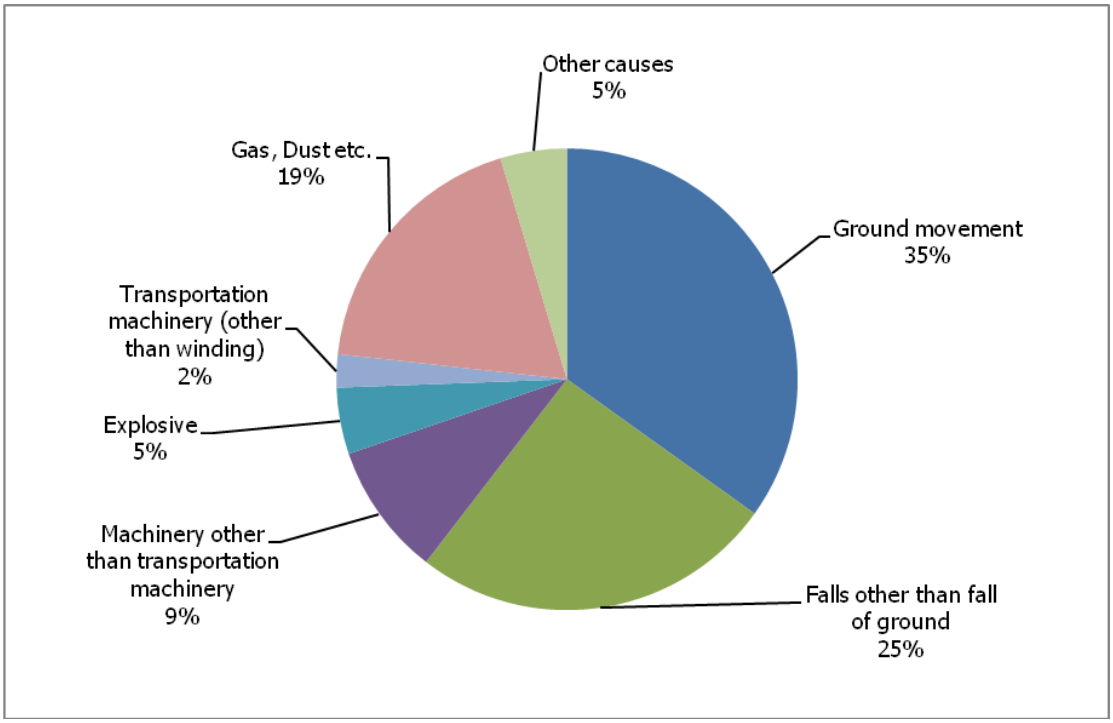


TABLE:37A	TREND IN FATAL ACCIDENTS IN DIFFERENT PLACES OF NON-COAL MINES				
Place	**2005**	**2006**	**2007**	**2008***	**2009***
Belowground	3 (3)	3 (3)	3 (3)	3 (4)	4 (5)
Opencast	34 (38)	42 (55)	38 (46)	36 (45)	30 (39)
Aboveground	11 (11)	13 (13)	15 (15)	16 (27)	9 (9)
Total	**48 (52)**	**58 (71)**	**56 (64)**	**55 (76)**	**43 (53)**

Note: Figures in parentheses denote the number of persons killed.
* Figures are provisional

TABLE: 38	TREND IN SERIOUS ACCIDENTS DUE TO DIFFERENT CAUSES IN NON-COAL MINES				
Cause	**2005**	**2006**	**2007**	**2008***	**2009***
Ground movement	2 (3)	2 (5)	4 (6)	1 (8)	1 (5)
Winding in shafts	-	1 (2)	2 (13)	2 (3)	3 (6)
Transportation machinery (other than winding)	14 (16)	12 (16)	10 (17)	9 (12)	11 (14)
Machinery other than transportation machinery	15 (15)	9 (9)	17 (21)	10 (12)	13 (14)
Explosive	1 (2)	-	1 (2)	1 (21)	1 (2)
Electricity	-	1 (1)	1 (1)	1 (3)	3 (3)
Gas, Dust etc.	3 (4)	-	1 (1)	1 (1)	-
Falls other than fall of ground	44 (44)	38 (40)	23 (24)	39 (39)	39 (39)
Other causes	29 (29)	15 (15)	20 (20)	19 (21)	23 (25)
TOTAL	**108 (113)**	**78 (88)**	**79 (105)**	**83 (120)**	**94 (108)**

Note: Figures in parentheses denote the number of persons seriously injured. This also includes serious injury out of fatal accidents.
* Figures are provisional

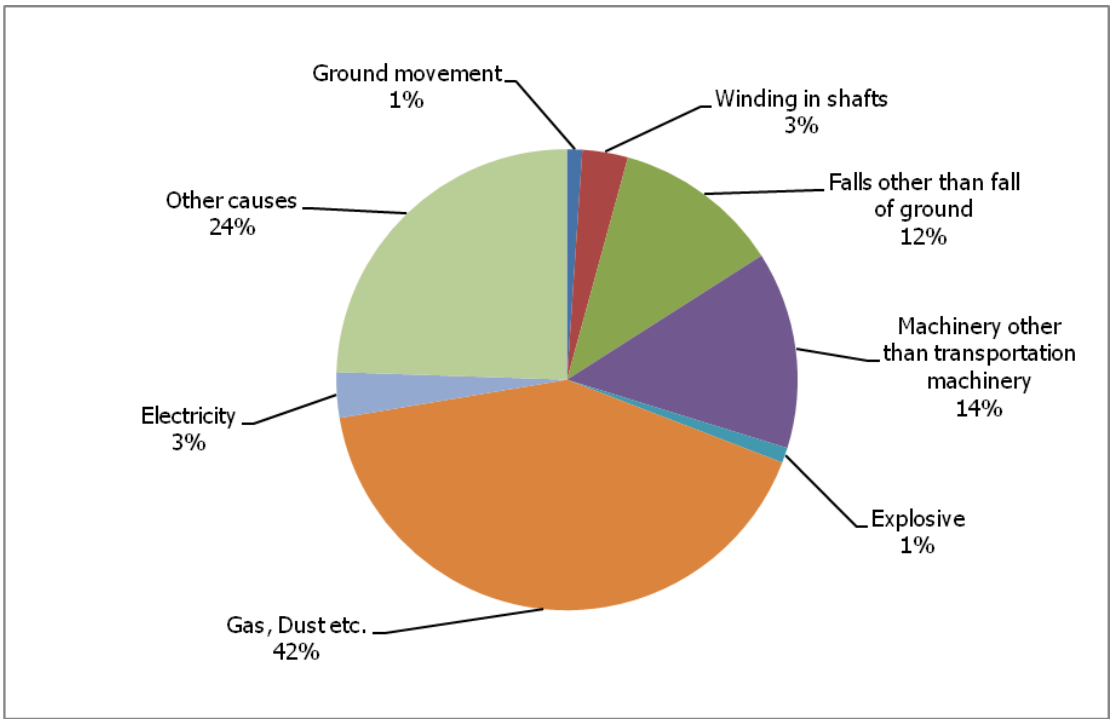


TABLE: 38A	TREND IN SERIOUS ACCIDENTS IN DIFFERENT PLACES OF NON-COAL MINES				
Place	**2005**	**2006**	**2007**	**2008***	**2009***
Belowground	27 (27)	24 (26)	19 (30)	15 (16)	30 (33)
Opencast	22 (27)	13 (21)	14 (28)	20 (30)	18 (26)
Aboveground	59 (59)	41 (41)	46 (47)	48 (74)	46 (49)
Total	**108 (113)**	**78 (88)**	**79 (105)**	**83 (120)**	**94 (108)**

Note: Figures in parentheses denote the number of persons seriously injured.
* Figures are provisional

Table: 39 shows fatal and serious accidents mineral-wise for the year 2005-2009

TABLE: 39	FATAL AND SERIOUS ACCIDENTS MINERAL-WISE IN NON-COAL MINES DURING 2005-2009									
Mineral	**Fatal accidents**					**Serious accidents**				
	2005	**2006**	**2007**	**2008***	**2009***	**2005**	**2006**	**2007**	**2008***	**2009***
Copper	-	-	-	1	1	4	-	1	3	5
Galena & sphalerite	1	1	1	2	-	24	12	14	21	24
Gold	-	1	1	-	1	10	9	6	9	15
Granite	6	6	4	6	4	1	-	-	1	-
Iron-ore	15	15	14	11	9	34	21	22	19	20
Lime stone	7	12	9	9	3	9	6	7	3	4
Manganese ore	-	2	1	3	1	5	7	5	2	2
Marble	3	4	11	5	4	-	-	-	-	-
Oil	1	4	3	5	4	15	15	16	20	18
Stone	8	4	7	6	7	-	-	-	-	-
Others	7	9	5	7	9	6	8	8	5	6
TOTAL	**48**	**58**	**56**	**55**	**43**	**108**	**78**	**79**	**83**	**94**

* Provisional.

3.2.2 Analysis of Accidents

The analysis of accidents presented below is based on the findings of enquiries into fatal accidents conducted by officers of DGMS and information regarding serious accidents received from the mine management.

3.2.2.1 Ground Movement

Number of accidents and fatalities due to ground movement shows a wavy trend in the last five years indicating that it is the high time for the mine management to think and execute an effective plan to reduce fatal accidents due this cause. Percentage wise there were 15 (35% of the total) fatal accidents due to ground movement in the year 2009 as compared to 14 (25% of the total) fatal accidents due to ground movement in the year 2008.

3.2.2.1A Roof fall Accidents

There were 4 (7.41% of total accident) fatal accident occurred due to roof fall during the year 2009 in non-coal mines.

3.2.2.1B Side fall Accidents

There were 9 (16.67% of total accident) fatal accidents occurred due to side fall during the year 2009 in non-coal mines.

3.2.2.2 Transportation machinery (Winding)

There was no accident reported due to transportation machinery (winding) during the year, 2009.

3.2.2.3 Transportation machinery (other than winding)

There were altogether 11 (25% of all fatal accidents) accidents involving 11 fatalities due to transportation machinery (other than winding) during the year 2009.

The cause-wise details may be seen from the following table:-

TABLE-40	**FATAL ACCIDENTS DUE TO TRANSPORTATION MACHINERY IN NON COAL MINES IN YEAR 2009**		
Sl. No.	Causes	Fatal	Persons Killed
1.	Rope Haulages	-	-
2.	Conveyors	1	1
3	Dumpers/Tippers	8	8
4	Wheeled Trackless(Truck,Tanker etc.)	2	2
5.	Others (Wagon)	-	-
	Total	**11**	**11**

The analysis of causes revealed the following:

Transportation machinery (other than winding)

Conveyor: One person died due to crush between running drum and belt.

Dumpers/Tippers: Eight accidents occurred causing eight killing due to truck and tanker contributing (72.7%) of total accidents due to this cause:

- Two accidents due to brake failure of dumper and tipper.
- Six accidents due to ran over of dumper and tipper.

Truck & Tanker: Two accidents occurred causing two killing due to truck & tanker contributing (18.1%) of total accident due this cause.

Other (Wagon): There is no accident due to this cause during the year 2009.

3.2.2.5 Accidents due to machinery other than transportation machinery.

TABLE-41	**BREAK UP OF SERIOUS & FATAL ACCIDENTS DUE TO MACHINERY OTHER THAN TRANSPORTATION MACHINERY IN NON COAL MINES DURING 2009**			
	FATAL		SERIOUS	
Causes	Surface	Underground	Surface	Underground
1. Loading Machines	-	-	-	1
2. Shovels etc.	-	-	2	-
3. Crane	-	-	-	-
4. Crushing Plant	1	-	-	-
5. Other HEMM	2	-	6	-
6. Others Non-Transportation Machinery	1	-	2	2
Total	**4**	**-**	**10**	**3**

It is seen that most accident due to transportation machinery and other machinery were caused due to operator's negligence, indiscipline and lack of supervisions. Improved standards of training and education of workers are necessary to control such accidents. Some cases the equipment failure was observed due to poor maintenance and called for higher standard of maintenance of machinery in the opencast sector.

Table: 42 - Detail break-up of serious accidents due to this cause during 2009.

TABLE : 42	BREAK-UP OF SERIOUS ACCIDENTS DUE TO MACHINERY OTHER THAN TRANSPORTATION MACHINERY IN NON-COAL MINES DURING 2009			
Cause	Number of serious accidents			
	Belowground	Opencast	Aboveground	Total
Loading Machines	1	-	-	1
Shovels, draglines, excavators etc.	-	-	2	2
Crushing & screening plants	-	-	-	-
Other HEMM	-	2	4	6
Others	2	1	1	4
TOTAL	**3**	**3**	**7**	**13**

3.2.2.5 Explosives

There were 2 (3% of the total) fatal accidents involving 4 persons and one serious accident involving two persons in 2009 as compared to 2 fatal accidents and 1 serious accident in 2008.

3.2.2.6 Electricity

There were no fatal accidents occurred and three serious accidents due to electricity during the year 2009.

3.2.2.7 Dust, Gas & other combustible material

There ware 1 (2.32% of the total) fatal accidents involving 1 person and no serious accident due to this cause during the year 2009.

3.2.2.8 Falls other than falls of ground

There were 8 (19% of the total)) fatal accidents involving 8 persons and 39 serious accidents occurred due to this cause during the year 2009, while 11 fatal accidents and 39 serious accidents during the year 2008.

3.2.2.9 Other causes

There was 2 (4.65% of the total) fatal accidents involving 2 persons and 23 serious accidents occurred due to miscellaneous causes during the year 2009.

3.3 Responsibility

The responsibilities fixed as a result of fatal accident enquiry conducted by officers of DGMS in the year 2009 is indicated in the table below:

TABLE:43	RESPONSIBILITY FOR FATAL ACCIDENTS IN NON-COAL MINES DURING THE YEAR 2009	
SL. NO.	Responsibility	No. of accidents
1.	Misadventure	1
2.	Management	19
3.	Management, Subordinate Supervisory Staff (SSS)	4
4.	Management, SSS, Co-Worker	1
5.	Management, Shotfirer	1
6.	Management , Co-worker	1
7.	Management, Deceased	2
8.	Subordinate Supervisory Staff (SSS)	4
9.	Co-Worker	2
10.	Co-Worker, Deceased	1
11.	Deceased	3
12.	Others	4
	TOTAL	**43**

3.4 Dangerous Occurrence

The table indicated below gives dangerous occurrences reported during the year 2009 under various causes:

TABLE:44	DANGEROUS OCCURRENCES IN NON-COAL MINES DURING 2009	
Sl.No.	Cause	No. of cases
1.	Overwinding of cages etc.	1
2.	Outbreak of fire belowground	-
3.	Outbreak of fire at surface	1
4.	Premature collapse of workings or failure of pillars	-
5.	Breakage of winding rope	-
6.	Breakdown of winding engine, crank shaft, bearing etc.	-
7.	Ignition or occurrence of inflammable gas	-
8.	Breakage, fracture etc of essential parts of machinery or apparatus whereby safety of persons was endangered	-
9.	Irruption of water	-
10.	Rock burst	-
11.	Bursting of equipment under high pressure	-
12.	Oil well blowout without fire	2
13.	Fire in pipeline/well heads	-
14.	Others	4
	TOTAL	**8**

3.5 Technical Developments

Total numbers of mines working by deploying HEMM is 710. Total number of machines and capacity of shovels and dumpers used is mines have been increased. The following table shows the different types of machines deployed in mines since 1990.

TABLE: 45	TREND IN USE OF HEMM IN NON-COAL OPENCAST MINES							
Year	No. of mines	Shovels			Dumper	Others	Machinery	
		Elec.	Diesel	Total			Total No.	Total HP
1990	300	80	474	554	2263	1253	4070	833780
1991	368	92	553	645	2744	1357	4746	979076
1992	397	99	566	665	3067	1457	5189	1060897
1993	438	92	697	789	3221	1505	5515	1111029
1994	479	103	720	823	3416	1597	5836	1185407
1995	448	97	753	850	2814	1354	5018	1034650
1996	457	68	841	909	3409	1261	5579	1197829
1997	470	60	851	911	3704	1442	6057	1142679
1998	534	44	939	983	4286	1433	6702	1215549
1999	539	63	965	1028	3662	1513	6203	1232870
2000	589	76	1055	1131	4038	1585	6754	1413520
2001	542	86	1026	1112	3696	1763	6571	1337737
2002	577	95	1107	1202	3928	1741	6871	1351329
2003	560	90	1020	1010	3945	1630	6485	1310221
2004	561	91	1025	1116	3960	1670	6746	1313450
2005	653	52	1452	1504	5509	1819	8832	1784635
2006	591	58	1,577	1635	5,543	2248	9,426	1,789,531
2007	614	92	1,626	1718	4,926	2057	8,701	1,834,838
2008	705	67	1,885	1952	6,514	2460	10,926	2,109,638
2009*	710	70	1915	1985	6825	2580	11390	2,215,119

*Provisional

Following table shows the various types and quality of explosives used in non-coal and quality in mines since 1990.

TABLE:46	TREND IN USE OF EXPLOSIVES IN NON-COAL MINES							
YEAR	Consumption of explosives in tonnes							
	NG Based	ANFO	LOX	Slurry large dia	Slurry small dia	Booster	Gun powder	Total
1990	4650	7912	1786	15703	1554	44	71	31720
1991	5793	10272	1148	20690	2262	44	63	40272
1992	4293	11868	648	23831	3309	51	59	44059
1993	3765	14087	244	22264	3601	37	60	44058
1994	3065	13448	260	22400	4015	29	68	43285
1995	3766	13767	171	23781	4546	42	105	46178
1996	3429	14520	124	23993	5053	30	93	47243
1997	2759	17964	39	15182	7256	42	113	43356
1998	1713	18719	154	17199	9126	52	111	47074
1999	1828	22151	153	18353	7159	30	86	49760
2000	1233	17887	148	25561	10333	94	113	55369
2001	1021	21476	140	24303	7877	81	92	55809
2002	1092	21111	368	26186	6640	128	88	55613
2003	1005	20471	238	36473	5279	176	88	63729
2004	1323	24547	168	36883	7300	253	111	70584
2005	1382	28085	168	40538	9892	501	130	80700
2006	608	33757	-	53240	6766	622	116	95146
2007	566	31179	457	57122	9940	437	73	97769
2008	655	38438	457	63282	7096	691	111	110730
2009*	687	40360	460	66446	7450	700	115	116218

*Provisional

3.6 Occupational Health & Environments

(a) Progress of Medical Examination in Non-Coal Mines:

TABLE: 47	PROGRESS OF INITIAL & PERIODICAL MEDICAL EXAMINATION DURING 2009 IN NON-COAL MINES			
Name of Company	Initial Medical Examination		Periodical Medical Exam.	
	Required	Provided	Required	Provided
OIL	229	229	1960	1742
MOIL	-	644	1440	1229
TATA	2496	2496	554	550
SAIL	10	10	1097	1039
IREL	419	419	555	655
UCIL	101	155	430	631
HGMCL	-	880	550	1048
NMDC	578	578	1131	947
NALCO	264	264	70	70
BALCO	109	109	350	263
HCL	1158	1158	364	284
HZL	1017	1017	1185	1262
ACC	377	377	229	266
MML	774	774	1018	799
OMC	904	809	1284	2606
APMDC	695	507	220	180
RSMM	-	63	-	-

(b) Cases of Notified Diseases in non-coal mines:

TABLE: 48	NUMBER OF NOTIFIED DISEASES DURING 2009 IN NON-COAL MINES	
Mining Companies	Name of disease	Number of cases
-	-	-

3.7 Vocational Training

Progress of vocational training imparted during the year in major non-coal mining companies has been reported in table below:

TABLE: 49	PROGRESS OF VOCATIONAL TRAINING IN NON-COAL MINES DURING THE YEAR 2009					
Cos.	No. of VT Centers	Basic Training		Refresher Training		Special Training Provided
		Required	Provided	Required	Provided	
OIL	1	-	1187	280	292	433
MOIL	1	-	449	1455	1337	-
TATA	5	2739	3968	396	364	2477
SAIL	10	215	149	839	652	1284
IREL	1	417	417	342	438	451
UCIL	5	479	479	475	375	510
HGMCL	1	140	140	560	460	229
NMDC	4	1409	1409	617	524	1197
NALCO	1	163	163	46	46	-
BALCO	2	139	139	460	568	21
HCL	4	1169	1169	318	146	61
HZL	4	3073	3073	950	960	638
ACC	8	335	335	197	224	213
MML	3	777	670	863	605	67
OMC	11	552	233	664	424	64
APMDC	2	695	640	220	180	157
RSMM	1	77	77	17	-	-

3.8 Workmen's Inspector, Welfare Officer & Safety Committee

TABLE: 50	NUMBER OF WORKMEN'S INSPECTOR IN POSITION, SAFETY COMMITTEE, WELFARE OFFICERS IN NON-COAL MINES DURING 2009					
Name of Company	Welfare Officers		Workmen Inspectors		Safety Committee	
	Required	Provided	Required	Provided	Required	Provided
OIL	6	6	18	18	6	17
MOIL	9	10	27	27	9	9
TATA	5	4	18	18	5	5
SAIL	10	10	30	38	10	10
IREL	3	3	9	11	4	4
UCIL	4	4	18	19	7	7
HGMCL	3	3	5	5	5	5
NMDC	4	4	16	16	4	4
NALCO	1	1	3	6	1	1
BALCO	3	3	4	4	2	2
HCL	4	4	13	13	8	8
HZL	4	4	16	16	12	12
ACC	2	2	11	11	10	12
MML	12	12	2	2	10	10
OMC	14	16	23	27	12	12
APMDC	1	1	3	3	1	1
RSMM	1	1	1	1	1	1

3.9 Mineral wise consolidated fatal accident statistics for the last 8 (eight) years in non-coal mines

Mineral	Year	Fatal Accidents								Death Rate per 1000 persons			
		Belowground		Opencast		Aboveground		Total					
		Accident	Killed	Accident	Killed	Accident	Killed	Accident	Killed	BG	OC	AG	TOTAL
Oil	2002	0	0	0	0	2	2	2	2	0.00	0.00	0.09	0.09
	2003	0	0	0	0	1	1	1	1	0.00	0.00	0.05	0.05
	2004	0	0	0	0	2	2	2	2	0.00	0.00	0.10	0.10
	2005	0	0	0	0	1	1	1	1	0.00	0.00	0.05	0.05
	2006	0	0	0	0	4	4	4	4	0.00	0.00	0.29	0.29
	2007	0	0	0	0	3	3	3	3	0.00	0.00	0.16	0.16
	2008	0	0	0	0	5	6	5	6	0.00	0.00	0.31	0.31
	2009	0	0	0	0	4	4	4	4	0.00	0.00	0.21	0.21
Apatite & Rock	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Phosphate	2003	0	0	0	0	1	1	1	1	0.00	0.00	1.09	0.49
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	1	1	0	0	1	1	0.00	1.12	0.00	0.54
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	1	1	0	0	1	1	0.00	0.95	0.00	0.50
Asbestos	2002	0	0	2	2	0	0	2	2	0.00	46.51	0.00	7.94
	2003	0	0	0	0	1	1	1	1	0.00	0.00	27.78	4.24
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	1	1	0	0	1	1	0.00	43.48	0.00	4.83
	2006	0	0	1	2	0	0	1	2	0.00	0.00	0.00	166.67
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Barytes	2002	0	0	0	0	1	1	1	1	0.00	0.00	3.79	2.24
	2003	0	0	1	2	0	0	1	2	0.00	12.66	0.00	5.21
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Bauxite	2002	0	0	2	2	0	0	2	2	0.00	0.53	0.00	0.44
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	1	1	0	0	1	1	0.00	0.23	0.00	0.20
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00

Mineral	Year	Fatal Accidents								Death Rate per 1000 persons			
		Belowground		Opencast		Aboveground		Total					
		Accident	Killed	Accident	Killed	Accident	Killed	Accident	Killed	BG	OC	AG	TOTAL
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
China,Clay,Clay,	2002	0	0	1	2	0	0	1	2	0.00	0.96	0.00	0.57
White-clay	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	1	1	0	0	1	1	0.00	0.57	0.00	0.32
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Chromite	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	1	1	0	0	0	0	1	1	1.73	0.00	0.00	0.13
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	1	1	0	0	0	0	1	1	1.50	0.00	0.00	0.14
	2007	1	1	2	2	1	1	4	4	1.41	0.57	0.31	0.54
	2008	0	0	1	1	0	0	1	1	0.00	0.29	0.00	0.13
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Copper	2002	1	1	0	0	0	0	1	1	0.46	0.00	0.00	0.30
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	1	1	1	1	0.00	0.00	1.61	0.41
	2009	1	1	0	0	0	0	1	1	0.62	0.00	0.00	0.41
Dolomite	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	1	1	1	1	0.00	0.00	1.43	0.41
	2004	0	0	1	1	0	0	1	1	0.00	0.56	0.00	0.44
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Felspar	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	1	1	0	0	1	1	0.00	7.19	0.00	5.85
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00

Mineral	Year	Fatal Accidents								Death Rate per 1000 persons			
		Belowground		Opencast		Aboveground		Total					
		Accident	Killed	Accident	Killed	Accident	Killed	Accident	Killed	BG	OC	AG	TOTAL
Galena &	2002	1	1	0	0	0	0	1	1	0.50	0.00	0.00	0.22
Sphalarite	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Galena &	2004	2	2	0	0	1	1	3	3	1.80	0.00	0.49	0.79
Sphalarite	2005	0	0	0	0	1	1	1	1	0.00	0.00	0.68	0.31
	2006	1	1	0	0	0	0	1	1	0.85	0.00	0.00	0.31
	2007	1	1	0	0	0	0	1	1	0.87	0.00	0.00	0.30
	2008	1	1	0	0	1	3	2	4	0.87	0.00	1.69	1.21
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Gold	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	1	1	0	0	0	0	1	1	0.63	0.00	0.00	0.32
	2007	1	1	0	0	0	0	1	1	0.66	0.00	0.00	0.33
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	1	1	1	1	0.00	0.00	0.64	0.33
Granite	2002	0	0	2	2	1	1	3	3	0.00	0.44	0.69	0.50
	2003	1	1	4	5	2	2	7	8	0.00	1.03	1.46	1.29
	2004	0	0	1	1	1	1	2	2	0.00	0.20	0.61	0.30
	2005	0	0	6	7	0	0	6	7	0.00	1.28	0.00	0.98
	2006	0	0	6	9	0	0	6	9	0.00	1.64	0.00	1.21
	2007	0	0	4	4	0	0	4	4	0.00	0.64	0.00	0.49
	2008	0	0	6	8	0	0	6	8	0.00	1.28	0.00	0.99
	2009	0	0	4	6	0	0	4	6	0.00	0.96	0.00	0.74
Graphite	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	1	1	0	0	1	1	0.00	2.92	0.00	2.70
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Gypsum	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	1	1	0	0	1	1	0.00	4.72	0.00	3.62
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Iron	2002	0	0	5	5	5	5	10	10	0.00	0.24	0.38	0.30

Mineral	Year	Fatal Accidents								Death Rate per 1000 persons			
		Belowground		Opencast		Aboveground		Total					
		Accident	Killed	Accident	Killed	Accident	Killed	Accident	Killed	BG	OC	AG	TOTAL
	2003	0	0	5	5	8	9	13	14	0.00	0.25	0.57	0.39
	2004	0	0	5	5	7	8	12	13	0.00	0.22	0.50	0.34
	2005	0	0	7	8	8	8	15	16	0.00	0.36	0.53	0.43
Iron	2006	0	0	10	16	5	5	15	21	0.00	0.68	0.28	0.51
	2007	0	0	7	7	7	7	14	14	0.00	0.29	0.39	0.34
	2008	0	0	7	7	4	4	11	11	0.00	0.29	0.22	0.26
	2009	0	0	7	7	2	2	9	9	0.00	0.29	0.11	0.22
Limestone	2002	0	0	8	11	2	2	10	13	0.00	0.58	0.32	0.52
	2003	0	0	6	8	0	0	6	8	0.00	0.43	0.00	0.33
	2004	0	0	11	12	1	1	12	13	0.00	0.63	0.17	0.52
	2005	0	0	6	6	1	1	7	7	0.00	0.30	0.17	0.27
	2006	0	0	10	13	2	2	12	15	0.00	0.65	0.35	0.59
	2007	0	0	7	11	2	2	9	13	0.00	0.51	0.32	0.47
	2008	0	0	7	7	2	2	9	9	0.00	0.32	0.32	0.32
	2009	0	0	3	3	0	0	3	3	0.00	0.14	0.00	0.11
Magnesite	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	2	2	2	2	0.00	0.00	12.74	1.20
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Manganese	2002	1	1	1	1	2	2	4	4	0.39	0.13	0.54	0.29
	2003	1	1	0	0	0	0	1	1	0.41	0.00	0.00	0.08
	2004	1	1	1	1	1	1	3	3	0.33	0.13	0.26	0.21
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	2	2	0	0	2	2	0.00	0.29	0.00	0.15
	2007	0	0	0	0	1	1	1	1	0.00	0.00	0.25	0.07
	2008	1	2	1	1	1	1	3	4	0.76	0.15	0.25	0.30
	2009	0	0	0	0	1	1	1	1	0.00	0.00	0.25	0.07
Marble	2002	0	0	2	3	0	0	2	3	0.00	2.58	0.00	1.95
	2003	1	2	5	5	0	0	6	7	0.00	4.46	0.00	4.64
	2004	0	0	6	9	1	1	7	10	0.00	7.85	2.60	6.53
	2005	0	0	3	3	0	0	3	3	0.00	2.51	0.00	1.85
	2006	0	0	4	4	0	0	4	4	0.00	2.53	0.00	2.01
	2007	0	0	11	14	0	0	11	14	0.00	9.05	0.00	7.16
	2008	0	0	5	7	0	0	5	7	0.00	4.52	0.00	3.58
	2009	0	0	4	5	0	0	4	5	0.00	3.23	0.00	2.56
Mica	2002	1	1	0	0	0	0	1	1	2.31	0.00	0.00	1.60
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00

Mineral	Year	Fatal Accidents								Death Rate per 1000 persons			
		Belowground		Opencast		Aboveground		Total					
		Accident	Killed	Accident	Killed	Accident	Killed	Accident	Killed	BG	OC	AG	TOTAL
	2004	1	1	0	0	0	0	1	1	2.39	0.00	0.00	1.58
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Mica	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Quartz	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	1	1	1	1	0.00	0.00	17.86	1.29
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	1	2	0	0	1	2	0.00	2.62	0.00	2.39
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	2	2	0	0	2	2	0.00	2.85	0.00	2.31
Sandstone	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	1	1	0	0	1	1	0.00	2.79	0.00	2.44
	2009	0	0	0	0	1	1	1	1	0.00	0.00	20.00	2.44
Silica	2002	0	0	2	2	0	0	2	2	0.00	0.93	0.00	0.71
	2003	0	0	1	1	1	1	2	2	0.00	0.47	1.46	0.71
	2004	0	0	1	2	1	1	2	3	0.00	0.90	1.22	0.98
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Sillimanite	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	1	1	1	1	0.00	0.00	0.55	0.33
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	1	1	1	1	0.00	0.00	0.56	0.27
Steatite	2002	0	0	2	2	0	0	2	2	0.00	0.62	0.00	0.48
	2003	0	0	3	3	2	3	5	6	0.00	0.99	4.46	1.54
	2004	0	0	1	1	0	0	1	1	0.00	0.31	0.00	0.25

Mineral	Year	Fatal Accidents								Death Rate per 1000 persons			
		Belowground		Opencast		Aboveground		Total					
		Accident	Killed	Accident	Killed	Accident	Killed	Accident	Killed	BG	OC	AG	TOTAL
	2005	0	0	2	2	0	0	2	2	0.00	0.63	0.00	0.49
	2006	0	0	1	1	0	0	1	1	0.00	0.31	0.00	0.24
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	1	1	3	4	0	0	4	5	3.88	1.14	0.00	1.10
	2009	1	2	1	1	0	0	2	3	7.75	0.28	0.00	0.66
Stone	2002	0	0	6	13	1	1	7	14	0.00	2.70	0.34	1.79
	2003	0	0	6	9	0	0	6	9	0.00	1.82	0.00	1.13
	2004	0	0	8	9	0	0	8	9	0.00	1.78	0.00	1.13
	2005	0	0	8	9	0	0	8	9	0.00	1.83	0.00	1.28
	2006	0	0	4	4	0	0	4	4	0.00	0.86	0.00	0.61
	2007	0	0	6	7	1	1	7	8	0.00	1.05	0.46	0.91
	2008	0	0	5	9	1	9	6	18	0.00	1.36	4.10	2.04
	2009	0	0	7	13	0	0	7	13	0.00	1.96	0.00	1.47
Vermiculite	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	1	1	0	0	1	1	0.00	27.78	0.00	23.26
All India	2002	5	5	33	45	14	14	52	64	0.49	0.54	0.21	0.40
	2003	3	4	31	38	18	20	52	62	0.52	0.45	0.31	0.40
	2004	5	5	36	42	16	17	57	64	0.62	0.47	0.26	0.39
	2005	3	3	34	38	11	11	48	52	0.38	0.43	0.17	0.32
	2006	3	3	42	55	13	13	58	71	0.38	0.62	0.21	0.45
	2007	3	3	38	46	15	15	56	64	0.35	0.48	0.22	0.37
	2008	3	4	36	45	16	27	55	76	0.47	0.47	0.40	0.44
	2009	4	5	30	39	9	9	43	53	0.59	0.41	0.13	0.31

BG – Belowground OC- Opencast AG- Aboveground

Note : Figures for the year 2008 & 2009 are provisional.

N.A. = Employment Figures not Available.

3.10 Mineral wise consolidated serious accident statistics for the last 8 (eight) years in non-coal mines

Mineral	Year	Serious Accidents								S/Injury Rate per 1000 persons employed			
		Belowground		Opencast		Aboveground		Total					
		Acc	S/Inj	Acc	S/Inj	Acc	S/Inj	Acc	S/Inj	BG	OC	AG	TOTAL
Oil	2002	0	0	0	0	31	31	31	31	0.00	0.00	1.39	1.39
	2003	0	0	0	0	21	22	21	22	0.00	0.00	1.18	1.18
	2004	0	0	0	0	38	40	38	40	0.00	0.00	2.09	2.09
	2005	0	0	0	0	15	15	15	15	0.00	0.00	0.78	0.78
	2006	0	0	0	0	15	15	15	15	0.00	0.00	1.08	1.08
	2007	0	0	0	0	16	16	16	16	0.00	0.00	0.83	0.83
	2008	0	0	0	0	20	22	20	22	0.00	0.00	1.15	1.15
	2009	0	0	0	0	18	20	18	20	0.00	0.00	1.04	1.04
Apatite & Rock	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Phosphate	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	1	2	0	0	1	2	0.00	1.90	0.00	1.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Asbestos	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	1	0	0	0	1	0.00	43.48	0.00	4.83
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Barytes	2002	0	0	0	0	1	1	1	1	0.00	0.00	3.79	2.24
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Bauxite	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	2	2	2	2	0.00	0.00	2.80	0.41
	2004	0	0	0	0	1	1	1	1	0.00	0.00	1.58	0.17

Mineral	Year	Serious Accidents								S/Injury Rate per 1000 persons employed			
		Belowground		Opencast		Aboveground		Total					
		Acc	S/Inj	Acc	S/Inj	Acc	S/Inj	Acc	S/Inj	BG	OC	AG	TOTAL
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Bauxite	2006	0	0	0	0	1	1	1	1	0.00	0.00	1.71	0.20
	2007	1	1	0	0	0	0	1	1	0.00	0.00	0.00	0.18
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	1	1	0	0	1	1	0.00	0.21	0.00	0.18
China Clay,	2002	0	0	0	1	0	0	0	1	0.00	0.48	0.00	0.28
Clay,White-clay	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	1	1	0	0	1	1	0.00	0.54	0.00	0.31
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Chromite	2002	0	0	0	0	1	1	1	1	0.00	0.00	0.41	0.14
	2003	0	0	1	1	0	0	1	1	0.00	0.28	0.00	0.15
	2004	1	1	0	0	0	0	1	1	1.73	0.00	0.00	0.13
	2005	0	0	0	0	1	1	1	1	0.00	0.00	0.33	0.14
	2006	0	0	0	0	1	1	1	1	0.00	0.00	0.33	0.14
	2007	0	0	1	2	1	1	2	3	0.00	0.57	0.31	0.40
	2008	0	0	0	1	0	0	0	1	0.00	0.29	0.00	0.13
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Copper	2002	2	2	2	3	1	1	5	6	0.92	11.90	1.09	1.79
	2003	0	0	2	2	2	2	4	4	0.00	8.40	1.77	1.58
	2004	0	0	0	0	1	1	1	1	0.00	0.00	1.50	0.49
	2005	0	0	4	4	0	0	4	4	0.00	12.90	0.00	2.07
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	1	1	0	0	0	0	1	1	0.62	0.00	0.00	0.41
	2008	1	1	1	1	1	3	3	5	0.62	4.26	4.83	2.03
	2009	4	4	1	4	0	0	5	8	2.49	17.02	0.00	3.25
Diamond	2002	0	0	2	2	0	0	2	2	0.00	40.00	0.00	9.71
	2003	0	0	0	0	1	1	1	1	0.00	0.00	5.65	4.41
	2004	0	0	1	1	0	0	1	1	0.00	20.00	0.00	4.76
	2005	0	0	0	0	1	1	1	1	0.00	0.00	6.76	5.13
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00

Mineral	Year	Serious Accidents								S/Injury Rate per 1000 persons employed			
		Belowground		Opencast		Aboveground		Total					
		Acc	S/Inj	Acc	S/Inj	Acc	S/Inj	Acc	S/Inj	BG	OC	AG	TOTAL
Dolomite	2002	0	0	0	0	1	1	1	1	0.00	0.00	1.35	0.45
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Dolomite	2004	0	0	1	1	1	1	2	2	0.00	0.56	2.20	0.89
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	1	1	1	1	0.00	0.00	1.36	0.37
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	1	1	1	1	0.00	0.00	1.36	0.37
Felspar	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Fluorite	2002	0	0	1	1	0	0	1	1	0.00	7.69	0.00	6.71
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Galena &	2002	9	9	2	2	12	12	23	23	4.46	7.07	5.46	5.12
Sphalarite	2003	11	11	1	1	10	10	22	22	8.16	1.66	6.34	6.24
	2004	21	21	2	2	7	7	30	30	18.85	3.26	3.42	7.94
	2005	14	14	0	0	10	10	24	24	13.46	0.00	6.75	7.43
	2006	7	7	3	3	2	2	12	12	5.92	8.77	1.14	3.66
	2007	7	7	0	0	7	7	14	14	6.10	0.00	3.95	4.24
	2008	8	9	5	5	8	9	21	23	7.84	13.19	5.08	6.97
	2009	13	16	3	3	8	9	24	28	13.94	7.92	5.08	8.48
Gold	2002	27	27	0	0	13	13	40	40	15.63	0.00	8.52	11.97
	2003	34	34	0	0	11	11	45	45	26.67	0.00	7.79	16.38
	2004	22	22	0	0	13	13	35	35	16.73	0.00	9.57	12.83
	2005	9	9	0	0	1	1	10	10	5.83	0.00	0.64	3.21
	2006	7	8	0	0	2	2	9	10	5.02	0.00	1.30	3.19

Mineral	Year	Serious Accidents								S/Injury Rate per 1000 persons employed			
		Belowground		Opencast		Aboveground		Total					
		Acc	S/Inj	Acc	S/Inj	Acc	S/Inj	Acc	S/Inj	BG	OC	AG	TOTAL
	2007	4	15	0	0	2	2	6	17	9.91	0.00	1.29	5.55
	2008	5	5	1	1	3	3	9	9	3.30	0.00	1.93	2.94
	2009	10	10	3	3	2	2	15	15	6.61	0.00	1.29	4.89
Granite	2002	0	0	0	0	1	1	1	1	0.00	0.00	0.69	0.17
	2003	0	0	0	1	0	1	0	2	0.00	0.21	0.73	0.32
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	1	2	0	0	1	2	0.00	0.37	0.00	0.28
	2006	0	0	0	1	0	0	0	1	0.00	0.18	0.00	0.13
	2007	0	0	0	1	0	0	0	1	0.00	0.16	0.00	0.12
	2008	0	0	1	5	0	0	1	5	0.00	0.80	0.00	0.62
	2009	0	0	0	1	0	0	0	1	0.00	0.16	0.00	0.12
Graphite	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	1	0	0	0	1	0.00	2.92	0.00	2.70
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Iron	2002	0	0	24	24	36	36	60	60	0.00	1.17	2.73	1.78
	2003	0	0	14	17	23	25	37	42	0.00	0.84	1.59	1.17
	2004	0	0	21	23	24	25	45	48	0.00	1.02	1.55	1.24
	2005	0	0	10	12	24	24	34	36	0.00	0.54	1.58	0.96
	2006	0	0	9	10	12	12	21	22	0.00	0.42	0.67	0.53
	2007	1	1	9	13	12	13	22	27	0.00	0.54	0.73	0.65
	2008	0	0	9	10	10	11	19	21	0.00	0.42	0.62	0.50
	2009	0	0	7	7	13	13	20	20	0.00	0.29	0.73	0.48
Limestone	2002	0	0	4	4	4	4	8	8	0.00	0.21	0.64	0.32
	2003	0	0	5	5	8	8	13	13	0.00	0.27	1.38	0.54
	2004	0	0	6	7	8	8	14	15	0.00	0.37	1.38	0.61
	2005	0	0	5	5	4	4	9	9	0.00	0.25	0.69	0.35
	2006	0	0	1	2	5	5	6	7	0.00	0.10	0.88	0.27
	2007	0	0	3	5	4	4	7	9	0.00	0.23	0.65	0.32
	2008	0	0	2	2	1	1	3	3	0.00	0.09	0.16	0.11
	2009	0	0	3	3	1	1	4	4	0.00	0.14	0.16	0.14
Magnesite	2002	0	0	2	2	2	2	4	4	0.00	1.04	5.97	1.78
	2003	0	0	1	1	0	0	1	1	0.00	0.59	0.00	0.47

Mineral	Year	Serious Accidents								S/Injury Rate per 1000 persons employed			
		Belowground		Opencast		Aboveground		Total					
		Acc	S/Inj	Acc	S/Inj	Acc	S/Inj	Acc	S/Inj	BG	OC	AG	TOTAL
	2004	0	0	0	0	1	1	1	1	0.00	0.00	3.70	0.58
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Magnesite	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	1	1	1	1	0.00	0.00	6.41	0.63
Manganese	2002	5	5	2	2	7	7	14	14	1.96	0.27	1.88	1.02
	2003	4	4	1	1	6	6	11	11	1.63	0.14	1.75	0.83
	2004	6	6	0	0	3	3	9	9	1.99	0.00	0.77	0.62
	2005	2	2	1	1	2	2	5	5	0.71	0.13	0.50	0.34
	2006	6	7	0	3	1	1	7	11	2.75	0.44	0.27	0.84
	2007	4	4	0	0	1	1	5	5	1.51	0.00	0.25	0.37
	2008	0	0	0	0	2	2	2	2	0.00	0.00	0.50	0.15
	2009	1	1	0	0	1	1	2	2	0.38	0.00	0.25	0.15
Marble	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	1	0	0	0	1	0.00	0.87	0.00	0.65
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	4	0	0	0	4	0.00	2.59	0.00	2.05
	2008	0	0	0	1	0	0	0	1	0.00	0.65	0.00	0.51
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Quartz	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Sandstone	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00

Mineral	Year	Serious Accidents								S/Injury Rate per 1000 persons employed			
		Belowground		Opencast		Aboveground		Total					
		Acc	S/Inj	Acc	S/Inj	Acc	S/Inj	Acc	S/Inj	BG	OC	AG	TOTAL
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Silica	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	2	0	2	0	4	0.00	0.94	2.92	1.42
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Silica	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	1	1	1	1	0.00	0.00	1.27	0.35
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Sillimanite	2002	0	0	0	0	1	1	1	1	0.00	0.00	0.79	0.65
	2003	0	0	0	0	1	1	1	1	0.00	0.00	0.54	0.29
	2004	0	0	0	0	2	2	2	2	0.00	0.00	1.10	0.66
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	2	2	2	2	0.00	0.00	1.13	0.70
	2007	0	0	0	0	2	2	2	2	0.00	0.00	1.12	0.55
	2008	0	0	1	1	1	1	2	2	0.00	0.53	0.56	0.55
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Steatite	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	1	1	0	0	1	1	0.00	0.31	0.00	0.25
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	3	0	0	0	3	0.00	0.85	0.00	0.66
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Stone	2002	0	0	1	3	0	0	1	3	0.00	0.62	0.00	0.38
	2003	0	0	0	5	0	0	0	5	0.00	1.01	0.00	0.63
	2004	0	0	2	10	0	0	2	10	0.00	1.98	0.00	1.26
	2005	0	0	0	1	0	0	0	1	0.00	0.20	0.00	0.14
	2006	0	0	0	1	0	0	0	1	0.00	0.22	0.00	0.15
	2007	0	0	0	1	0	0	0	1	0.00	0.15	0.00	0.11
	2008	0	0	0	0	0	20	0	20	0.00	0.00	9.12	2.27
	2009	0	0	0	4	0	0	0	4	0.00	0.60	0.00	0.45
Vermiculite	2002	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2003	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2004	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2005	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00

Mineral	Year	Serious Accidents								S/Injury Rate per 1000 persons employed			
		Belowground		Opencast		Aboveground		Total					
		Acc	S/Inj	Acc	S/Inj	Acc	S/Inj	Acc	S/Inj	BG	OC	AG	TOTAL
	2006	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2007	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2008	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
	2009	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00
Atomic Mineral	2002	9	9	0	0	2	2	11	11	N.A.	N.A.	N.A.	N.A.
	2003	8	8	0	0	1	1	9	9	N.A.	N.A.	N.A.	N.A.
Atomic Mineral	2004	4	4	0	0	1	1	5	5	N.A.	N.A.	N.A.	N.A.
	2005	2	2	0	0	1	1	3	3	N.A.	N.A.	N.A.	N.A.
	2006	4	4	0	0	0	0	4	4	N.A.	N.A.	N.A.	N.A.
	2007	1	1	0	0	0	0	1	1	N.A.	N.A.	N.A.	N.A.
	2008	1	1	0	0	1	1	2	2	N.A.	N.A.	N.A.	N.A.
	2009	2	2	0	0	1	1	3	3	N.A.	N.A.	N.A.	N.A.
All India	2002	52	52	40	44	113	113	205	209	5.06	0.53	1.72	1.31
	2003	57	57	25	36	86	92	168	185	7.36	0.43	1.45	1.19
	2004	54	54	34	46	100	103	188	203	6.70	0.52	1.57	1.25
	2005	27	27	22	27	59	59	108	113	3.41	0.30	0.93	0.71
	2006	24	26	13	21	41	41	78	88	3.33	0.24	0.67	0.56
	2007	19	30	14	28	46	47	79	105	3.51	0.29	0.70	0.61
	2008	15	16	20	30	48	74	83	120	1.87	0.32	1.10	0.70
	2009	30	33	18	26	46	49	94	108	3.86	0.27	0.73	0.63

BG- Belowground OC- Opencast AG- Aboveground

N.A. = Employment Figures not Available.

Note : i) Figures for the year 2008 & 2009 are provisional.

ii) Seriously injureds from fatal accidents are also considered for computation of no. of serious injury as well as for serious injury rate.

4.0 Approval of Equipment, Appliances, Material and Machinery

Several equipments, appliances, materials and machineries meant for use in mines are required to be approved by DGMS; a list of such equipments is given at Appendix-V. Table below shows particulars of items approved during the year 2009.

Equipment, appliances, materials and machinery approved during the year 2009		
Sl. No.	Equipment/appliances/materials/ machinery	No. of approvals granted/renewed/ extended during the year
1.	Methanometer	3
2.	Helmet	8
3.	Cap Lamp	10
4.	Footwear	19
5.	Gas Detector/Monitor	2
6.	Cap Lamp Bulb	1
7.	Ventilation ducting	3
8.	Co detector tubes/aspirator	1
9.	Environmental monitoring system	1
10.	Safety goggles	2
11.	Ear plug	2
12.	Visibility harness	1
13.	Dust Respirator (Mask)	6
14.	Full Body Harness/Safety Belt	2
15.	Flame Safety Lamp	2
16.	Noise Dosi Meter	1
17.	Self-rescuers	2
18.	Resuscitator/Reviving Apparatus	2
19.	Hydraulic props	-
20.	Powered support & its components	1
21.	STDA Legs	2
22.	Explosives	33
23.	Exploders	4
24.	Detonators	29
25.	Flame proof equipment - motor, switches, circuit breakers etc	89
26.	Intrinsically safe apparatus	35
27.	Equipment for use in hazardous area	76
28.	Cables	33
29.	Gas Detector and Monitor	4
30.	Cage suspension gears	12
31.	Fire resistant conveyor belting	2
32.	Automatic contrivance	5
33.	Man riding system	2
34.	Fire resistant hydraulic fluid	7
35.	High pressure hose	2
36.	Accreditation of Test House	3
37.	Chair lift system	1
38.	Top man emergency escape device & escape line	1
39.	Audio Video Alarm	1
40.	Winding Rope	1
41.	Automatic Recording Speed Indicator	2
	TOTAL	**345**

5.0 Coal & Metalliferous Mining Examinations during 2009

(i) Board of Mining Examinations under the CMR, 1957

Shri S.J. Sibal	Director General of Mines Safety
Shri Ashok Kumar Singh	Chairman & Managing Director, M/s. Central Mine Planning & Design Institute Ltd.
Shri Mukti Pada Dixit	Chairman & Managing Director, M/s. S.E.C.L.
Dr. Ashish Bhattacharjee	Prof. & Head of Department, Department of Mining Engineering, IIT, Kharagpur
Shri Shree Ramji Upadhyay	Chairman & Managing Director M/s. Mahanadi Coalfields Ltd.
Shri J.V. Duttatreyulu	Director (Operations), M/s. Singareni Collieries Co. Ltd.

(ii) Board of Mining Examinations under the MMR, 1961

Shri S.J. Sibal	Director General of Mines Safety
Dr. Upendra Kumar	Head & Deptt. Of Mining Engineering, Indian School of Mines University, Dhanbad
Shri V.K. Agrawal	Sr. Vice President, Indian Metals & Ferro Alloys , IMFA Building, Jaipur Road
Dr. B.K. Shrivastava	Prof. & Coordinator, Centre of Advanced Studies, Deptt. of Mining Engg., Banaras Hindu University, Varanasi.
Shri D. Acharya	Director (Tech), M/s. UCIL, P.O. Narwapahar, East Singhbum
Shri Akhilesh Joshi	Chief Operation Officer, M/s. HZL, Udaipur

Examiners for Certificates of Competency

Coal Mining Examinations

(a) Following were the Examiners for Manager's Certificates of Competency Examinations held in 2009.

Subject	First Class manager's Certificate	Second Class Manager's Certificate
Mine Management, Legislation & General Safety	Shri S. Puri	Shri P.K. Sarkar
Winning & Working	Shri R. Sinha	Shri N. Kumar
Mine Ventilation	Shri B.K. Saxena	Shri A.K. Singh
Mining Machinery & Electricity	Shri N. Das	Shri Om Prakash
Mine Surveying	Shri Suresh	Shri M. Shishu Kr. Reddy

(b) Following were the Examiners for Surveyor's Certificate of Competency Examinations held in 2009.

Surveying Paper-I	Shri A. K. Sinha
Surveying Paper-II	Shri V. Devanandan

Metal Mining Examinations

(a) Following were the Examiners for Manager's Certificates of Competency Examinations held in 2009.

Subject	Ist Class manager's Certificate (Un-Restricted	IInd Class Manager's Certificate (Un-Restricted)
Mine Management, Legislation & General Safety	Shri S. I. Hussain	Shri U. Saha
Winning & Working	Shri Kabir Ghosh	Shri R.R. Kumar
Mine Ventilation, Explosion, Fires & Inundation	Shri A.K. Sen	Shri A.K. Lal
Mining Machinery	Shri P.K. Sen	Shri M. Kundu
Mine Surveying	Shri S.C. Bhowmik	Shri A.K. Bhowmick

Subject	Ist Class manager's Certificate (Restricted)	IInd Class Manager's Certificate (Restricted)
Mine Management, Legislation & General Safety	Shri R. B. Chakraborty	Shri D. Sengupta
Winning & Working	Shri L.S. Rathore	Shri N.K. Nanda
Mining Machinery	Shri M. Venkatiah	Shri Y.S. Reddy
Mine Surveying	Shri N.K. Dhawan	Shri L.N. Mathur

(b) Following were the Examiners for Surveyor's Certificate of Competency Examinations held in 2009

Surveyor's Certificate Restricted to Opencast Mines	Shri P. Kumar
Surveyor's Certificate (Un-restricted) Part – I	Shri A. Biswas
Part – II	Shri A.K. Sahay

Other particulars regarding various examinations held are given in **Appendix-IV.**

6.0 National Safety Awards (Mines)

6.1 Introduction

During the post-independence era, the mineral industry in India has achieved tremendous growth and also imbibed the latest mining technologies. Along with this growth, there has been corresponding awareness of the need to protect the health and lives of workers. The Constitution of India casts an obligation on all of us to ensure just and humane conditions of work. To give due recognition to outstanding safety performance at the national level, the Ministry of Labour, Government of India, instituted the National Safety Awards (Mines) in 1983 for the contest year 1982.

6.2 Scope

The scheme is applicable to all mines, which come under the purview of the Mines Act, 1952. Such mines have been classified into 7 groups as given below:

i. Coal mines - Below ground with difficult mining conditions
ii. Coal mines - Belowground (others)
iii. Coal mines - Opencast
iv. Metal mines - Mechanized opencast
v. Metal mines - Manual opencast
vi. Metal mines - Belowground
vii. Oil mines

6.3 Schemes

Among different indices available, the following two have been accepted as indicator of safety performance:

1. Longest accident free period (LAFP) in terms of manshifts worked during three consecutive years ending with the contest year.

2. Lowest injury frequency rate (LIFR) during three consecutive years ending with the contest year.

It is expected that every mine shall endeavour to improve its safety performance. A bad mine has a high injury frequency rate. After obtaining a breakthrough, its next attempt should be to achieve longest accident-free period in terms of manshifts worked.

6.4 Awards Committee

The awards committee is constituted by the Ministry of Labour & Employment with Director-General of Mines Safety as its Chairman, eight representatives of mine managements, eight representatives of trade unions and an officer of DGMS as its Member-Secretary.

6.5 Mode of operation

An advertisement is released through DAVP in English, Hindi and other regional languages inviting applications in prescribed proforma for National Safety Awards (Mines). An entry fee of Rs.100/- per application is charged through a crossed IPO drawn in favour of the Administrative Officer/DDO, DGMS and payable at Dhanbad Post Office. The prescribed application form is jointly signed by the mine management and a workers' representative.

6.6 Presentation of awards

National Safety Awards (Mines) for the contest year 2007 was given away on 23rd October 2009 at New Delhi by the Hon'ble Vice President of India.

7.0 Conference on Safety in Mines

The Conference on Safety in Mines is a tripartite forum at the national level in which the employers' representatives, the trade unions' representatives, the Government represented by Ministry of Labour & Employment, DGMS, various administrative ministries/departments and State Governments and associated institutions, professional bodies, service associations, etc. take part. They review status of the safety in mining industry and the adequacy of existing measures in a spirit of mutual cooperation. The conference also suggests measures for further improvement in safety, welfare and health of mine workers. The first such Conference was held in the year 1958 followed by the 2nd in July, 1966, the 3rd in 1973, the 4th in 1978, the 5th in 1980, the 6th in 1986, the 7th in 1988, the 8th in 1993, the 9th in 2000 and the 10th Conference was held on 26th & 27th November, 2007 in New Delhi.

8.0 Plan Schemes

In order to provide in-house technical support to field offices, DGMS is implementing following Plan Schemes namely:

Ongoing schemes:

(1) "Mine Accident Analysis and Modernization of Information Database (MAMID)"
(2) "Strengthening of Core Functions of DGMS (SOCFOD)"

8.1 "Mine Accident Analysis and Modernization of Information Database (MAMID)"

This is the restructured plan scheme after merging of the two Plan Schemes of Tenth Plan (2002-07) namely (i) Study of Mines Accidents and Development of Mines Safety Information System (SOMA) and (ii) Modernization of Information Database in DGMS (MID) as per the Report of Working Group on Occupational Safety & Health for 11th Five Year Plan 2007-12 of Ministry of Labour and Employment, Government of India. - Oct 2006. Keeping the objective of integration in view, these schemes were merged into one scheme "Mine Accident Analysis and Modernization of Information Database (MAMID)"

Objective of the Scheme:

(A) Mine Accident Analysis and Information Database

- ✓ To eliminate risk of disasters and accidents in mines through detailed analysis of accidents and dangerous occurrences using risk assessment and risk management techniques;

- ✓ Development of standard Safe Operating Procedures (SOPs) and Code of Safe Practices (COPs);

- ✓ Identification of mines having potential of accidents/disasters through detailed investigation into the operating systems and environment in the mine;

- ✓ Development of mine data acquisition system and analysis through computerized databases and processing system;

- ✓ Dissemination of mine information system through various reports, technical instructions/guidelines, circulars on electronic as well as other conventional media;

- ✓ Identification of mines having high accident potential and formulation of risk elimination/management plan;

(B) Computerized Mine Safety Information System

- ✓ Computerization of process and procedures on Mine Safety Information in DGMS;
- ✓ Establishment of Communication Network using LAN and WAN in DGMS;

The major activities taken up during the year included –

- Publication of Annual Report, 2008 and compilation of Annual Report for the year 2009.
- Publication of Standard Note on DGMS as on 1.1.2009
- Analysis of data for Identification of accident-prone mines in respect of coal & lignite mines.
- Compilation of statistics and preparation of manuscript for –
  - Statistics of Mines in India, Vol.I (Coal), 2008
  - Statistics of Mines in India, Vol.II(Non-Coal), 2008
  - Monthly Review of Accidents and
  - Report on Monthly Inspection Analysis
- National Safety Awards (Mines) for the contestant years 2007 was given away.

Accident Prone Mines:

A modified approach for identification of accident-prone mines was adopted; data from all the mines of eleven coal companies were collected. In-depth analysis of all fatal and serious accidents that occurred in all 519 coal mines and 10 lignite mines of the country during the periods 2005-2009 were made and based on the outcome of the study, the accident-prone mines were identified. This was done with a view to identify hazard potential of such mines and draw up action programmes for formulation of mitigating measures through collective efforts of Mine Management, Trade Unions and the Government.

The following table shows the number of accident-prone mines identified in different coal companies in last five years.

Name of company	**Number of mines identified as accident prone**				
	2005	**2006**	**2007**	**2008**	**2009**
ECL	9	8	6	7	7
BCCL	8	6	8	7	12
SECL	8	6	8	5	8
MCL	3	1	1	2	5
WCL	9	8	7	7	8
CCL	7	4	6	2	7
NCL	1	1	1	1	3
NECL	0	0	1	1	1
SCCL	10	5	6	4	7
TISCO	2	1	1	2	1
IISCO	0	1	1	1	1
Total	**57**	**41**	**46**	**39**	**60**
LIGNITE	**-**	**1**	**3**	**3**	**2**

The respective companies were advised to take suitable steps from technical and management point of view to identify the potential risk of the respective mines and to device

suitable corrective measures and implement the same in a time bound period so that the accidents are reduced.

Reports of enquiry into all fatal accidents were scrutinized. Finalized causes and circumstances leading to these accidents were compiled for inclusion in DGMS Annual Report.

8.2 "Strengthening of Core Functions of DGMS (SOCFOD)"

This is a continuing plan scheme. The scheme had been formulated by merging three on-going plan schemes of DGMS, namely (1) "Augmentation of S&T Capabilities, Mine Rescue Services and Human Resource Development (S&T)(1975)", (2) "Strengthening of Machinery for Conduct of Statutory Examinations (SSEX)(2000-01)" and (3) "Improving Efficiency by Providing Infra Structure Facilities in DGMS (PIF)(" along with components like Occupational Safety and Health Surveillance, promotional initiatives and Emergency Response system.

Objectives of the Scheme:

The objectives of the scheme are:

- To render scientific and technological support to the enforcement wing of DGMS in proper fulfillment and discharge of its statutory duties, responsibilities and advisory role.

- To develop, improve and update need based rescue and emergency response services to the mining industry & to help field offices of DGMS in the form of technical support while taking up rescue and emergencies of specific nature.

- To establish Mine Safety & Health Academy with institutes at different offices of DGMS for imparting structured training to DGMS officers and key personnel of the mining industry.

- Strengthening of Machinery for Conduct of Statutory Examinations

- To develop a structured mechanism for Occupational Health Surveillance & Disease Control in Mining Industry.

- To establish a National Council for Mines Safety with a view to generate safety and health awareness among miners and address their training issues.

- To improve the efficiency of DGMS by providing better infrastructure facilities which include providing own office buildings and residential complexes to the officers and staff members, providing better communication facilities and office equipment and furnishing of offices.

The overall activities are broadly divided into three components:

(1) Science & Technology (S&T) Component:

The Studies and Investigations, Research & Development, Monitoring and Assessment of Hazards that were undertaken and still continuing, are given below:

- Studies and Investigations into the existing methodology and techniques of exploration and exploitation of various types of minerals for improvement in the standards of Safety and Occupational Risks associated therewith

- Studies and Investigations into the new methodology and techniques of exploration and exploitation of various types of minerals for improvement in the standards of Safety and Occupational Risks associated therewith

- Development, Updation and advancement of methods, techniques, processes and materials through interactions, investigations, training etc.

- Standardization of prototype tests and accreditation of testing laboratories /test houses

- Guidelines for accreditation of testing laboratories/test houses

- Guideline for testing steel chocks , Propos, Powered Supports, and other support materials

- Standardization of Ultrasonic Testing Technique and formulation of Acceptance & Rejection Norms for components and vital parts of the machinery & equipment including winding ropes and guides.

- Technical Direction and Guide Lines on various subjects to support the Inspection wings of DGMS as well as to the industry.

- Special Investigations and Studies on :-

    i) Strata Control and Rock Mechanics
    ii) Development of Hidden Slip Detector FOR COAL MINES
    (iii) Explosives and Blasting Techniques for improving efficiency and reducing blasting hazards
    (iv) Mines Gases, Fires & Explosions for control and monitoring to ensure safety against dangers associated therewith.

(v) Classification of Coal Seam/Mine Prone to Spontaneous Combustion and Fire on Scientific Basis.

- Development of Mine Disaster Control Plan & Emergency Response Mechanism
- Modernization and furnishing of DMRS Laboratories with latest testing instruments and equipments including training
- Medical Examinations, Surveillance and control of Silicosis, Pneumoconiosis, Manganese Poisoning and other occupational disease and disorders in mines.
- Development and furnishing of OSH Laboratories in HQ and other field Offices.
- Establishing a fully equipped Central Mines Safety and Health Academy with Institutes at Dhanbad and Nagpur and creating a core team of well-trained faculty members to train DGMS officers and key personnel in mining industry.
- To develop basic training aids and safety manuals/monographs for use at the institutes and also at in-house training centers in mining companies.

During the year 2009, the following activities were undertaken by S&T wing:-

Activity	Achievement
(A) Augmentation of S&T Capabilities:	
1. Mine Environment surveys	20
2. Occupational Health Review, Survey & Medical exam	09
3. Ground Control.	09
4. Mine Mechanization	-
5. Additional job: Gas analysis	01
6. Additional job: FRHF	-
(B) Development of Mines Rescue Services:	
1. Testing of self rescuers	-
2. Testing of Self-contained Self Rescuer	-
3. Rescue competition	02
4. Field Visits	-
5. Organization of conference on Rescue/Recovery Experience	-
6. Monitoring of First Aid Competition	03
7. Creation of Rescue Databases on Rescue facilities	-
8. Creation of Rescue Databases on actual Rescue/Recoveries	-
9. Issue of technical circulars	-
(C) Human Resource Development	
1. Conduct of training programs:-	
(a) DGMS Officers	51
(b) Key personnel from mining industry	36
(c) Workmen's Inspectors	12

(2) SSEX Component of the Scheme

1.	Procurement of computers & peripherals	Continued
2.	Procurement of Office equipment	Continued
3.	Furnishing of offices	Continued
4.	Establishing exam section at Nagpur	Continued
5.	System Study	Under study
6.	System review	Under review
7.	Application software development	In progress
8.	Testing and implementation of software	In progress
9.	Training	In progress
10.	Design & development of the web content of the examination-specific web pages	In progress
11.	Design & development of online application form.	In progress
12.	Development of other internet- enabled services with enterprise-wide WAN connectivity.	In progress

(3) PIF Component:

1.	Modular furnishing of conference hall at Sitarampur	Under progress
2.	Providing and fixing of 100 KVA DG set at Sitarampur	Under progress
3.	Const. of boundary wall around the DGMS plot at Bilaspur	Under progress
4.	Providing and construction of pavement in front of office and main gate Bellary	Under progress
5.	Providing, placing and fixing of PVC tank with separate water pipe line for drinking water and utility at DGMS colony at Ajmer	Completed
6.	Renovation of toilets in office bldg of DGMS at Ajmer	Completed
8.	Construction of office and residential buildings of DGMS at Goa	Under progress
9.	Construction of office and residential buildings of DGMS at Jabalpur	Under progress

APPENDIX-I

SAFETY, HEALTH & WELFARE

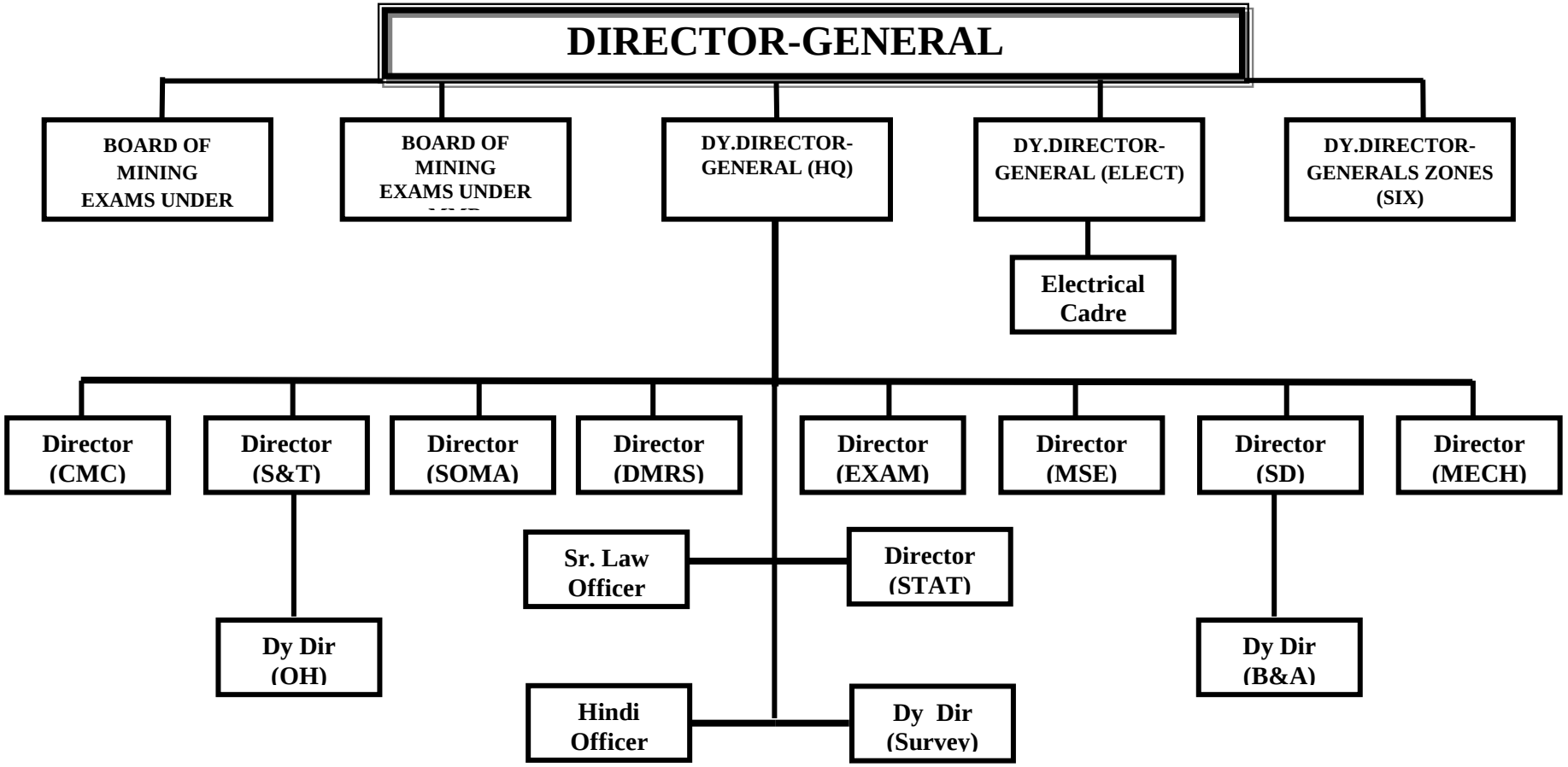
LEGISLATION FOR MINES

ADMINISTERED BY DGMS

- **The Mines Act, 1952**
  - → **The Coal Mines Regulations, 1957**
  - → **The Metalliferous Mines Regulations, 1961**
  - → **The Oil Mines Regulations, 1984**
  - → **The Mines Rules, 1955**
  - → **The Mines Vocational Training Rules, 1966**
  - → **The Mines Rescue Rules, 1985**
  - → **The Mines Crèche Rules, 1966**
  - → **Coal Mines Pit Head Bath Rules, 1959**
- **Electricity Act, 2003**
  - → **Indian Electricity Rules, 1956**
- **Allied Legislation**
  - → **Factories Act, 1948 – Chapter III & IV**
  - → **Manufacture, Storage & Import of Hazardous Chemicals Rules,1989 - under Environmental (Protection) Act, 1986**
  - → **Land Acquisition (Mines) Act, 1885**
  - → **Coal Mines Conservation & Development Act, 1974**

ANNEXURE-IIA

ORGANISATION STRUCTURE
DIRECTORATE-GENERAL OF MINES SAFETY
HEAD QUARTERS, DHANBAD



APPENDIX-IIB

Field Organisation of
Directorate General of Mines Safety

SN	Zone	Region	Sub-Region
1.	Eastern Zone **Sitarampur** West Bengal	1. Sitarampur Region No.I 2. Sitarampur Region No.II 3. Sitarampur Region No.III 4. Guwahati	
2.	Central Zone **Dhanbad** Jharkhand	**1. Dhanbad Region No.I** 2. Dhanbad Region No.II 3. Dhanbad Region No.III 4. Koderma	
3.	South Eastern Zone **Ranchi** Jharkhand	**1. Ranchi** 2. Bhubaneshwar 3. Chaibasa **4. Raigarh**	**Ramgarh**
4.	North Western Zone Udaipur Rajasthan	1. Ahmedabad 2. Udaipur 3. Surat	
5.	Northern Zone Ghaziabad Uttar Pradesh	1. Ghaziabad 2. Ajmer 3. Gwalior 4. Varanasi	
6.	Southern Central Zone Hyderabad Andhra Pradesh	**1. Hyderabad Region No.I** **2. Hyderabad Region No.II** **3. Goa**	**Nellore**
7.	Southern Zone Bengaluru Karnataka	**1. Bengaluru** 2. Bellary 3. Chennai	
8.	Western Zone Nagpur Maharashtra	1. Nagpur Region No.I 2. Nagpur Region No.II 3. Jabalpur 4. Bilaspur	**Parasia**

APPENDIX-III

STATEMENT SHOWING THE NAMES OF OFFICERS GROUP (A&B) OF DIFFERENT DISCIPLINES AS ON 31.12.2009

Sl.No.	Designation	Name of Officers S/Shri	Place of Posting	Date of Posting
1.	Director General of Mines Safety	Surinder Jit Sibal	Dhanbad	01.05.2009
2.	Dy.Director-General of Mines Safety (Mining)	Satish Puri	Hyderabad	30.04.2008
		Rahul Guha	Nagpur	27.12.2006
		S.I.Hussain	Sitarampur	03.06.2008
		R.B.Chakraborty	CZ, Dhanbad	07.11.2007
		D.Sen Gupta	Ranchi	01.12.2007
		P.K.Sarkar	Ajmer	23.02.2009
		Utpal Saha	HQ Dhanbad	01.05.2009
3.	Director of Mines Safety (Mining)	Bhisham Pratap Ahuja	Chennai	15.10.2003
		Mohan Singh	Ghaziabad Region	08.03.2004
		Anup Biswas	Ranchi	18.06.2007
		Akhilesh Kumar	Exam	08.05.2007
		Kuldip Kumar Sharma	Udaipur	31.05.2007
		B.P.Singh	S&T, Dhanbad	11.09.2006
		Arun Kumar Jain	Sitarampur, Region-I	26.07.2007
		Pulavarty Ranganatheeswar	Hyderabad,R-I	28.05.2007
		Prem Chand Rajak	Hyderanad	23.05.2008
		Swapan Kumar Dutta	Sitarampur,R-III	28.05.2007
		Rakesh Kulsrestha	Sitarampur,R-II	27.07.2007
		Ashok Kumar Megharaj	Goa	24.05.2007
		Ashim Kumar Sinha	Gaziabad	30.05.2007
		S Krishnamurthy	Hyderabad	27.02.2009
		Munna Tandi	Chaibasa	24.05.2007
		Dileep kumar Saxena	Nagpur, Region I	18.08.2003
		Vallala Lakshminarayana	Bilaspur	27.11.2009
		Koneru Nageshwara Rao	Nagpur,R-II	07.05.2007
		Suraj Mal Suthar	Dhanbad, Region-II	01.08.2005
		Narayan Rajak	Central Zone, R-I	15.11.2007
		D.K.Mallick	SD,Dhanbad	05.12.2007
		Vidyapathi	Nagpur,	29.05.2007
		Durga Das Saha	Bubneshwar	17.06.2009
		R.Subramanian	SOMA, Dhanbad	06.03.2009
4.	Dy.Director of Mines Safety (Mining)	Narendra Murawat	Sitarampur, R-I	28.11.2006
		Sheo Shankar Mishra	Goa	28.05.2007
		Manindra Satyamurty	Gaziabad	19.06.2009
		Chandra Bhanu Prasad	Hyderabad R.II	29.05.2007
		Niranjan Sharma	Gaziabad	28.05.2007
		Dinesh Kumar Sahu	Digboi	07.10.2009
		Gubba Vijay Kumar	Nellore	30.05.2008
		Ram Avtar Mal Parakh	HQ	21.05.2007
		Measala Narsaiah	Digboi	11.06.2007
		Sanjibon Ray	HQ	10.08.2009
		Uttam Kumar Saha	Dhanbad	26.05.2008
		Subhashis Roy	Sitarampur, R-III	30.05.2007
		Cherukuri Ramesh Kumar	Nagpur, R-II	14.05.2007
		Umesh Kumar Sharma	Ramgarjh,Ranchi	28.05.2007
		Elpula Jayakumar	CZ Dhanbad	26.10.2009
		Tapan Kanti Mondal	Exam	21.05.2008
		Muni Ram Mandve	CZ, RI	05.06.2007
		Prabir Kumar Palit	CZ RI Dhanbad	29.06.2004
		Sujay Kumar Gangopadhyay	Chennai	11.07.2007
		Satish Kumar Chabra	Dhanbad	----------

		Jainendra Kumar Roy	Dhanbad (SOMA)	17.05.2004
		Satish Kumar	Jabalpur	05.06.2007
		Subhro Bagchi	Sitarampur, R-II	17.05.2007
		Burgula Papa Rao	Hyderabad	21.05.2008
		Samiran Kumar Das	Ghaziabad	08.07.2005
		Subrat Halder	Dhanbad	19.05.2008
		Umesh Prasad Singh	Gaziabad	03.08.2009
		Kamlesh Shrama	Hyerabad R-2	24.08.2009
		PramodKumar Maheshwari	Udaipur	07.08.2009
		Prabhat Kumar	Dhanbad	12.05.2008
		Malay Tikader	Sitarampur R-2	24.08.2009
		Susanta Kumar Mandal	Ajmer	21.10.2009
		Ujjwal Tah	Chaibasa	29.05.2007
		Manish Eknath Murkute	Parasia	15.05.2008
		Satish Digamber Chiddarwar	Bilaspur	09.06.2008
		Rafique Syed	NagpurRegion-I	03.08.2009
		Arvind kumar	Koderma	31.05.2007
		Ram Abhilash	Bilaspur	07.07.2008
		Bhagwan Lal Meena	Udaipur	28.05.2007
		Mihir Choudhary	Ranchi	27.05.2008
		Ashok Kumar Porwal	Ghaziabad	29.07.2008
		Prabhat Kumar Kundu	Chaibasa	21.05.2007
		Ravindra Tulshi Mandekar	Chennai	25.05.2007
		Harish Chandra Yadav	Nagpur, Region-II	16.05.2007.
		Bhushan Pd. Singh	CZ	16.05.2007
		Deo Kumar	Ranchi	30.11.2007
		S.S.Prasad	Bhubneshwar	03.09.2007
		Rajib Pal	Sitarampur	25.05.2007
		B.B.Satiar	Ajmer	22.05.2008
		Ramawatar Meena	Ajmer	13.06.2008
		Manoranjan Dole	Dhanbad R-3	01.07.2008
		Vir Pratap	Dhanbad R-1	17.11.2009
		Supriyo chakraborty	Nagpur	03.11.2009
		S.Chandramouli	Sitarampur	12.02.2009
		T.R..Kannan	SOMA	02.03.2009
		Niraj Kumar	Hyderabad	20.08.2009
		Murlidhar Bidari	Exam	27.03.2009
		Saifullah Ansari	CZ R-3	31.08.2009
		Vinodanand Kalundia	S & T	27.02.2009
		M.C..Jaiswal	Hyderabad R-1	27.02.2009
		Murli Dhar Mishra	Sitarampur R-3	30.12.2009
5.	Dy.Director General of Mines Safety (Elect.)	R.Ramachandiran	Dhanbad (HQ)	13.09.2007
6.	Director of Mines Safety (Elect.)	Dharmendra Kumar	Hyderabad	20.09.2004
		Bijay Kumar Panigrahi	Sitarampur	20.09.2004
		B.K.Lama	Nagpur	05.11.2009
		K.M.Ghosh	Ranchi	05.11.2009
		M.K.Das	HQ	09.11.2009
		Mukesh Srivastava	CZ	05.11.2009
		U.N.Pandey	CZ	09.11.2009

		G.P.Rao	Hyderabad	09.11.2009
		S.K.Thakur	Sitarampur	24.11.2009
		G.L.K.Rao	Gaziabad	05.11.2009
		B.S.Nim	Ajmer	09.11.2009
7.	Dy.Director of Mines Safety (Elect.)	Radhey Shyam	Ajmer	15.07.2003
		K Satyanarayana Yadav	Hyderabad	09.07.2007
		Mahesh Kumar Malviya	Nagpur	19.05.2008
		Madhukar Sahay	CZ	13.08.2009
		Ajay Singh	Sitarampur	26.02.2009
		T.Srinivas	CZ	30.03.2009
8.	Director of Mines Safety, (Mech.)	G.N.Venketsh	HQ	30.10.2008
		Hemant Kumar Srivastava	Sitarampur	31.10.2008
9.	Dy.Director of Mines Safety, (Mech.)	Dinesh Pandey	Hyderabad	28.05.2007
		S.Venkatraman	HQ	26.08.2002
		B N Dhore	Nagpur	08.05.2007
		Raj Narayan Singh	CZ	28.05.2008
		Pramod Kumar Singh	Ranchi	31.03.2009
10.	Dy.Director (OH)	A.K.Sen	Sitarampur	12.05.2009
11.	AD(OH)Gr.I	George John	HQ	30.05.2008
		Kaushik Sarkar	HQ	04.06.2009
12.	Dir./Jt.Director (Stat.)	Tarak Chandra Patra	Dhanbad	30.07.2008
13.	Dy.Director (Stat.)	Prabodh Saxena	Dhanbad	25.08.2008
		B.K.Srivastava	Dhanbad	10.10.2009
14.	Sr.Law Officer	Tapan Kumar Barman	Dhanbad	27.03.2007
15.	Law Officer, Gr.I	Anand Swarup Singh	Dhanbad	07.08.2007
16.	Law Officer, Gr.II	Jai Prakash Jha	Dhanbad	28.01.2002
		Ritu Srivastava	Dhanbad	15.05.2008
		A.K.Sinha	Dhanbad	01.01.2006
17.	Asstt. Director (OL)	Sita Ram Sharma	Dhanbad	01.07.1997
		Monika Tudu	Dhanbad, CZ	25.01.2002
18	Administrative Officer	A.K.Bhattacharjee	Sitarampur	01.08.2007
		Dipak Mukherjee	Dhanbad	24.09.2008
		Namita Chakraborty	CZ Dhanbad	16.03.2009
		S.Y.Saiyed	Hyderabad	19.10.2007
19	Sr.Private Secretary	Kalyan Mandal	Dhanbad	01.04.2005
	Private Secretary	V.M. Wagh	Nagpur	23.04.1990
		Jagannath Ram	Ranchi	26.10.2005
		R.P.Rajak	Dhanbad(HQ)	01.02.2007
		K.D.Hansda	NZ	08.01.2008
		Damodar Prasad	Dhanbad	24.11.2008
		S.N.Singh	CZ Dhanbad	09.03.2009
		Mahendra Chaudhary	Sitarampur	03.08.2009
21	Jr.Scientific Officer	Krishna Kant Banerjee	Dhanbad (S&T)	
22	Sr.Accounts Officer	Ram Lalit Kannaujia	Dhanbad	25.11.1997
23	Statistical Investigator, Gr.I	Pramod Chandar	Dhanbad	25.09.2000
		Daya Shankar Singh	Dhanbad	26.07.2004
		Qasim Khan	Dhanbad	11.07.2005

APPENDIX-IIIA

LIST OF GROUP A & B OFFICERS OF DGMS ON DEPUTATION

DURING 2009

Sl. No.	Name	Place of posting	Period of deputation	Date of commencement
1.	M Satyamurthy, Dy. Director of Mines Safety(Mining)	Ministry of Agro & rural Ind, New Delhi & Presently he is on deputation in planning commission a Joint Advisor(Coal) from 17.10.2003 in New Delhi	5 Years	08.09.2001

APPENDIX-IIIB

OFFICERS OF DGMS ON TRAINING / VISITS ABROAD IN 2009

Sl. No	Name	Country visited	Scheme under which the visit took place	Dates
1.	Sri Satish Puri, DDG	South Africa	Studying Continuous Miner Technology Practices	10.01.2009 to 20.01.2009
2.	Shri SJ Sibal, DDG			
3.	Sri P. Ranganatheswar, Director			
4.	Shri R. Subramanian, DD			
5.	Shri SJ Sibal, DG	China	Underground Longwall Technology and Testing of Powered Support	07.05.2009 to 22.05.2009
6.	Shri BP Singh, Director			
7.	Dr. AK Sinha, Director			

APPENDIX-IIIC

OFFICERS OF DGMS ON TRAINING IN INDIA DURING 2009

S.N	Name	Name of course	Venue	Dates
1.	Shri Anup Biswas, Dir	Two Weeks Specialized Interactive Training Course on Oilfield Operations	IPSEM, GOA & Ankleswar	23.03.2009 to 04.04.2009
2.	Shri AK Jain, Dir			
3.	Shri P. Ranganatheswar, Dir			
4.	Shri BN Mishra, Dir			
5.	Shri N. Murawat, Dir			
6.	Shri UK Saha, DD			
7.	Shri SS Mishra, DD			
8.	Shri DK Sahu, DD			
9.	Shri G. Vijaykumar, DD			
10.	Shri Subhashish Roy, DD			
11.	Shri CR Kumar, DD			
12.	Shri PK Palit, DD			
13.	Shri BK Lama, DD			
14.	Shri BN Dhore, DD			
15.	Shri TK Mondal, DD			

16.	Shri Satish Puri, DDG	Review of on going Central and State Scheme/Projects/ Programmes	Gulberga	07.09.2009
17.	Dr. AK Sinha, Dir	Mainstreaming Disaster Risk Reduction in Development	New Delhi	22.12.2009 to 24.12.2009

APPENDIX-IV

A-COAL MINES REGULATIONS,1 957
STATEMENT NO. IA
Result of Examinations, 2009.

1**. Issue of Certificate:**

S.No.	Type of Examinations	2009		Remarks
		Appeared	Passed	
1.	**Exchange Certificate**			
(a)	First Class Manager's Exchange Certificate in Lieu of British Certificates	-	-	
(b)	First Class Manager's Certificate Metal to Coal	-	-	
(c)	First Class Manager's Certificate Coal to Metal	10	9	
(d)	Second Class Manager's Certificate Metal to Coal	-	-	
(e)	Second Class Manager's Certificate Coal to Metal	-	-	
(f)	Surveyor's Certificate Metal to Coal	-	-	
(g)	Foreman to Overman	-	-	
(h)	Mate's (UR) to Sirdar	-	-	
II	**Regular Examination**			
(a)	First Class Manager's Certificate	1982	308	
(b)	Second Class Manager's Certificate	1466	308	
(c)	Surveyor's Certificate	263	41	
(d)	Overman's Certificate	1315	153	
(e)	Sirdar's Certificate	782	261	
(f)	Shotfirer's Certificate	-	-	
(g)	Gas-testing Certificate	750	375	
(i)	Winding Engine Driver's Certificate (a) I Class (b) II Class	 22 36	 17 24	

STATEMENT NO.IB

Certificate without examination (Exempted Categories)

S.No.	Type of Examination	2009		Remarks
		Applied	Issued	
(a)	First Class Manager's Certificate	-	-	* also included certificates in respect o applications received during previous year.
(b)	Second Class Manager's Certificate	139	98	
(c)	Surveyor's Certificate	25	36*	

(d)	Overman's Certificate	292	266	

2. Medical Examination:

Five Year Medical Examination under Regulation 27(1)

S.No.	Type of Examination	2009		Remarks
		Appeared	Passed	
I	Overman's Certificate	570	545	
II	Sirdar's Certificate	605	585	
III	Shotfirer's Certificate	10	09	
IV	Winding Engine Driver's Certificate			
	(a) First Class	92	85	
	(b) Second Class	51	50	

3. Senior Medical Examination Board Under Regulation 28:

S.No.	Type of Examination	2009		Remarks
		Appeared	Passed	
I	First Class Manager's Certificate	52	45	
II	Second Class Manager's Certificate	23	20	
III	Surveyor's Certificate	08	06	

4. Junior Medical Examination Board under Regulation 28:

S.No.	Type of Examination	2009		Remarks
		Appeared	Passed	
I	Overman's Certificate	62	58	
II	Sirdar's Certificate	71	60	
III	Shotfirer's Certificate	-	-	
IV	Winding Engine Driver's Certificate			
	(c) First Class	12	10	
	(d) Second Class	05	05	

STATEMENT NO. II

Suspension of Certificates under the Coal Mines Regulations, 1957 for the Year 2009

S.No.	Type of Certificate	No. of Certificates Suspended	Duration of Suspension
1.	Sirdar	One	One month
2.	Overman	One	One month

STATEMENT NO. III

Debarment from appearing in Examination under the Coal Mines Regulations, 1957 for the Year 2009

S.No.	Name	Type of Certificate	Period of debarment
1.	Shri Chote Lal Mandal	Sirdar's Certificate of Competency	5 years debarment
2.	Shri Vikas Kumar	Sirdar's Certificate of Competency	5 years debarment
3.	Shri Amardeep Kumar Mandal	Sirdar's Certificate of Competency	5 years debarment

STATEMENT NO. IV

Duplicate Certificate issued under Coal Mines Regulations, 1957 during the Year 2009.

S.No.	Name	Type of Certificate	No. of Certificate	Date of issue
1.	Manoj Kr. Pandey	Surveyor	SRV/COAL/608	20.02.2009

DUPLICATE CERTIFICATES (GAS-TESTING**)** ISSUED UNDER COAL MINES REGULATIONS, 1957 DURING THE YEAR 2009

S.No.	Name	Type of Certificate	No. of Certificate	Date of issue
1.	Shri Shiv Prasad Singh	Gas Testing	30739	12.02.2009

B – METALLIFEROUS MINES REGULATIONS, 1961

STATEMENT NO. 1A

Result of Examinations, 2009

1**. Issue of Certificate:**

S.No.	Type of Examinations	2009		Remarks
		Appeared	Passed	
1.	**Exchange Certificate**			
(a)	First Class Manager's Certificate Metal to Coal	4	3	
(b)	Second Class Manager's Certificate Coal to Metal	-	-	
(c)	Surveyor's Certificate Coal to Metal	-	-	
(d)	Overman to Foreman	-	-	
(e)	Sirdar to Mate	-	-	
A.	**Regular Examination (Un-Restricted)**			
(a)	First Class Manager's Certificate	133	30	
(b)	Second Class Manager's Certificate	100	10	
(c)	Surveyor's Certificate	05	Nil	
(d)	Foreman's Certificate	20	10	
(e)	Mining Mate	55	19	
(f)	Blaster	19	07	
B.	**Regular Examination (Restricted)**			
(a)	First Class Manager's Certificate	1018	168	

(b)	Second Class Manager's Certificate	711	87	
(c)	Surveyor's Certificate	83	05	
(d)	Foreman's Certificate	260	56	
(e)	Mining Mate	499	202	
(f)	Blaster	07	1	-
C.	**Regular Certificate Other than above**			
(a)	Winding Engine Driver's Certificate (a) I Class (b) II Class	 15 32	 11 12	

STATEMENT NO.II

SUSPENSION OF CERTIFICATES UNDER THE MATALLIFEROUS MINES REGULATIONS, 1961 FOR THE YEAR 2009

S.No.	Type of Certificate	No. of Certificates Suspended	Duration of Suspension
NIL			

STATEMENT NO.III

DEBARMENT FROM APPEARING IN EXAMINATION UNDER THE MATALLIFEROUS MINES REGULATIONS, 1961

S.No.	Name	Type of Certificate	Period of debarment
1.	Shri Uttam Kumar,	Survey (Restricted)	5 years debarment
2.	Shri Shashi Kant Sharma	Survey (UR)	5 years debarment

STATEMENT NO.IV A

CERTIFICATE WITHOUT EXAMINATION (EXEMPTED CATEGORIES)

S.No.	Type of Certificates	2009				Remarks
		Un-restricted		Restricted		
		Applied	Issued	Applied	Issued	
(a)	I Class Manager's Certificate					
(b)	II Class Manager's Certificate	26	19	229	178	
(c)	Surveyor's Certificate	03	03	16	17	
(d)	Foreman's Certificate	24	17	173	133	

STATEMENT NO.IV B

S.No.	Type of Examination	2009		Remarks
		Appeared	Passed	
A	**Five Yearly Medical Examination Under Regulation 30(1):**			
I	Foreman's Certificate	621	588	
II	Mining Mate's Certificate	585	554	
III	Blaster's Certificate	23	19	
IV	Winding Engine Driver's Certificate (c) First Class (d) Second Class	 - -	 - -	

B	**Yearly Medical Examination Under Regulations 31:**			
I	First Class Manager's Certificate	62	58	
II	Second Class Manager's Certificate	57	50	
III	Surveyor's Certificate	15	10	
C	**Yearly Medical Examination Under Regulations 31:**			
I	Foreman's Certificate	95	86	
II	Mining Mate's Certificate	67	56	
III	Blaster's Certificate	24	21	
IV	Winding Engine Driver's Certificate (a) First Class (b) Second Class	 - -	 - -	

STATEMENT NO.V

DUPLICATE CERTIFICATES ISSUED UNDER METALLIFEROUS MINES REGULATIONS, 1961 DURING THE YEAR 2009.

S.No.	Name	Type of Certificate	No. of Certificate	Date of issue
1	Manoj Kr. Pandey	Surveyor (R)	SVR/R/14	20.02.2009
2.	Kartik Ram Bareth	Mate	6740	20.02.2009

DUPLICATE CERTIFICATES (GAS-TESTING) ISSUED UNDER METALLIFEROUS MINES REGULATIONS, 1961 DURING THE YEAR 2009.

S.No.	Name	Type of Certificate	No. of Certificate	Date of issue
	Nil			

APPENDIX-V

1. List of Mines Safety Equipment and Material required to be approved by DGMS under Coal & Metalliferous Mines Regulations.

Equipment/Material	Provision of Regulation	
	CMR, 1957	**MMR,1961**
1. Flame Safety Lamp	2(2)	2(2)
2. Cap Lamps	2(2)	2(2)
3. Permitted Explosives	2(23)	2(23)
4. Tub Couplings	89(1)(c)	97(1)(c)
5. CO Detector	113(3)(c) 118A(3)(a)(i) 119(1)(b),121 125(3)(b) 142(5)	116(3)(c) 120(1)(b) 120(2)(c) 122, 126(3)(b) 141(5)
6. CO_2 Detector	119(2)(d)(ii)	-
7. Dust Extractor	123(3)(b)	124(2)(b)
8. Stone Dust Barrier	123(c)(2)	-
9. Methanometers	145(1)(a)	-
10. Glass of Flame Safety Lamp	157(4)	151(4)
11. Cap Lamp Bulbs	157(4)	151(4)
12. Oil for Flame Safety Lamp	157(5)	151(5)
13. Mechanically propelled vehicle for transport of explosive	164(A)(2)(a)	-
14. Exploders	174	165(3)
15. Protective Footwear	191	182
16. Helmet	191-A	182-A
17. Self-Rescuers	191D	-
18. Fire-resistant brattices including plastic sheeting and ventilation ducting	181(3)	-
19. Safety belt	181(3)	-
20. Friction Props & Props setting devices	181(3)	-
21. Hydraulic roof supports	181(3)	-
22. Link Bars	181(3)	-
23. Powered Supports	181(3)	-
24. Fire resistant hydraulic fluid	181(3)	-
25. Man-riding haulage system	181(3)	-
26. Detaching hook	181(3)	-
27. Cage suspension gear including bridle chains	181(3)	-
28. Winding Rope	181(3)	-

29. Balance Rope	181(3)	-
30. Haulage rope for man-riding	181(3)	-

Equipment/Material	Provision of Regulation	
	CMR, 1957	MMR,1961
31. Conveyor belting	181(3)	-
32. Locomotive	181(3)	-
33. Internal combustion engine	181(3)	-
34. Flame proof & intrinsically safe electrical equipment	181(3)	-
35. Cables	181(3)	-
36. Automatic Contrivance	181(3)	-
37. Power Brake	181(3)	-
38. Automatic speed chart recorder	181(3)	-
39. Water ampoules/gel ampoules for stemming explosive charges	181(3)	-

2. List of equipment required to be approved by DGMS under Mines Rescue Rules, 1985

Equipment	Provision of Mines Rescue Rules, 1985
1. Breathing apparatus	Rules 11(5)
2. Smoke helmets & apparatus	Rules 11(5)
3. Reviving apparatus	Rules 11(5)
4. Electric Safety Lamps & Flame Safety Lamps	Rules 11(5)
5. Gas Detectors	Rules 11(5)
6. Self-Rescuers	Rules 11(5)

3. List of equipment and material required to be approved under Oil Mines egulations, 1984.

Equipment/Material	Provision of Regulation
1. Safety belt and life line	27
2. Petroleum storage tanks (specification approval)	55
3. Pipe lines and fittings (specification approval is not as per ISS)	62
4. Electrical lighting apparatus	84
5. Protective footwear	87
6. Protective helmet	88
7. Electrical equipment for use in hazardous area (Zone 1 and 2)	73

APPENDIX-VI

NOTIFICATIONS & CIRCULARS

Notifications – 2009

New Delhi, the 12th January, 2009

S.O. 119 (E) In exercise of the powers conferred by sub-section (8) of Section 24 of the Code of Criminal Procedure, 1973 (2 of 1974), the Central Government hereby appoints the following officers in the Directorate General of Mines Safety/Ministry of Labour and Employment, as Special Public Prosecutors for the conduct of cases instituted under the Mines Act, 1952 (35 of 1952), in trial courts, cases, revisions and other matters arising out of these cases of provisional or appellate Courts, established by Law in any State or Union Territory to which the provisions of the aforesaid section apply :-

(1) Shri Tapan Kumar Barman, Senior Law Officer
(2) Shri Anand Swrup Singh, Law Officer, Gr. I

[F.No.S-29026/3/2007-ISH.II]
S.K. SRIVASTAVA, Jt. Secy.

New Delhi, the 06th May, 2009

S.O.1176 (E). Shri S.J. Sibal, Deputy Director General of Mines Safety, (Mining), Directorate General of Mines Safety (Headquarters), Dhanbad on his appointment as Director General of Mines Safety in the Directorate General of Mines Safety, Dhanbad has taken over the charge of the post with effect from the forenoon of 1st May, 2009.

2. Therefore, in exercise of the powers conferred by sub-section (1) of Section 5 of the Mines Act, 1952 (35 of 1952), the Central Government hereby, appoints Shri S.J. Sibal, Director General, Directorate General of Mines Safety, Dhanbad to be the Chief Inspector of Mines for all the territories to which the said Act extends.

[No. A-32012/02/2008-ISH-II]
S.K. SRIVASTAVA, Jt. Secy.

New Delhi, the 13th January, 2009

G.S.R. 9. In exercise of the powers conferred on the Chief Inspector of Mines also designated as Director General of Mines Safety under sub-regulation (3) of Regulation of 181 of the Coal Mines Regulations, 1957 an sub-regulation (1) of Regulation of 73 of the Oil Mines Regulations, 1984, I hereby declare 1st March, 2009 as the date from which all types of lights, lighting Fixtures and system including lights on board mobile machinery, in HEMMs, Machinery and Plants, Indicators or Signal lights to be used in mines both on surface and belowground including oil and gas mines/fields will be of such type, standard and make as approved by me by a general or special order in writing.

[No.N-12019/2/2009/S&T(HQ)/16]
M.M. SHARMA, Director General of Mines Safety.

New Delhi, the 08th May, 2009

No.A-32012/01/2008-ISH.II. The President is pleased to appoint the following officers to the post of Deputy Director General of Mines Safety (Mining) in the pre-revised pay scale of Rs. 18,400-500-22,400/- in the Directorate General of Mines Safety, Dhanbad with effect from the dates shown against their names and until further orders.

Sl. No.	Name of the Officers	Date of appointment in the Grade of Deputy Director General of Mines Safety (Mining)
1	Sh. P.K. Sarkar	23.02.2009 (FN)
2	Sh. Utpal Saha	01.05.2009 (FN)

SUBHASH CHAND, Under Secy.

New Delhi, the 29th May, 2009

No.Q-16012/2/2009-ESA (NLI)-Whereas the V.V. Giri National Labour Institute, Sector-24, Noida has been registered as a Society under the Societies Registration Act, 1860 (Punjab Amendment Act, 1957).

And Whereas Rule-III, of the Rules & Registration of the said society provides for its constitution.

Now the term of the existing General Council of V.V. Giri National Labour Institute, Noida, with the approval of the Hon'ble LEM, has been extended for a period of three months beyond 29.05.2009 or until further orders.

PRADEEP GAUR, Under Secy.

New Delhi, the 27th May, 2009

No. Law/G-22/09/319-I, Surinder Jit Sibal, Chief Inspector of Mines and also designated as Director General of Mines Safety, by virtue of powers conferred on me under Section 75 of the Mines Act, 1952 (35 of 1952) and in supersession of all the notifications published earlier in any mine situated within their respective Inspection Jurisdiction as declared under sub-section (3) of section 6 of the said Act.

SURINDER JIT SIBAL, Chief Inspector of Mines &
Director General of Mines Safety

New Delhi, the 11th June, 2009

No. A-12025/05/2006-ISH-II. The President is pleased to appoint the following officers to the post of Deputy Director of Mines Safety (Mining) in the pre-revised Pay Scale Rs. 12,000-375-16,500/- in the Directorate General of Mines Safety, Dhanbad with effect from the date shown against their names and until further orders :-

Sl. No.	Name of the Officers	Date of appointment in the Grade of Deputy Director General of Mines Safety (Mining)
1	Shri Vir Pratap	31/10/2008 (F/N)
2	Shri Supriyo Chakraborty	07/05.2009 (F/N)
3	Shri Chandramouli S.	12/02/2009 (F/N)
4	Shri T.R. Kannan	02/03/2009 (F/N)
5	Shri Niraj Kumar	04/05/2009 (F/N)
6	Shri Muralidhar Bidari	26/02/2009 (F/N)
7	Shri Saifuliah Ansari	06/03/2009 (F/N)
8	Shri Vinodanand Kalundia	27/02/2009 (F/N)

SUBHASH CHAND, Under Secy

New Delhi, the 08th October, 2009

S.O. 2552 (E). In exercise of the powers conferred by Section 12 of the Mines Act, 1952 (35 of 1952) read with rule 3 of the Mines Rules, 1955, and in supersession of the notification of the Government of India in the Ministry of Labour and Employment, number S.O. 778 (E), dated the 18th May, 2006 except as respects things done or omitted to be done before such supersession, the Central Government hereby constitutes, for the purposes of the said Act, a Committee consisting of the following

members, with effect from the date of publication of this notification in the Official Gazette, namely :-

Appointed under clause (a) of sub-section (1) of Section 12

1. The Special Secretary or Additional Secretary in the Ministry of Labour and Employment - Chairman

Appointed under clause (b) of sub-section (1) of Section 12

2. The Chief Inspector of Mines, Directorate General of Mines Safety, Dhanbad - Member

Appointed under clause (c) of sub-section (1) of Section 12

3. Shri Hare Krishna Nayak, President, Akhil Bhartiya Ispat Mazdoor Mahasangh, Qr. No. Rly/8-A. At and P.O. Meghahatuburu – 833233, District West Singhbhum (Jharkhand). - Member

4. Shri Assem Das, South Eastern Koyla Mazdoor Congress, 109, MIG, Rajendra Prasad Nagar, Korba, Chattisgarh - Member

Appointed under clause (c) of sub-section (1) of Section 12

5. Shri Vinay Kumar Singh, Chairman-cum-Managing, Director Northern Coalfields Limited, Singrauli District – Sidhi, (M.P.) - Member

6. Shri N.K. Nanda Director (Tech), National Mineral Development Corporation Limited, Khanji Bhawan, 10-3-311/A, Castle Hills, Masab Tank, Hyderabad- 500028.

Appointed under clause (c) of sub-section (1) of Section 12

7. Prof. D.C. Panigrahi Department of Mining Engineering Indian School Of Mines, Dhanbad - Member

8. Dr. Amalendu Sinha, Director Central Institute For Mining and Fuel Research Barwa Road, Dhanbad,

[F.No. U-15011/03/09-ISH-II]
S.K. SRIVASTAVA, Addl. Secy.

6th November 2009

S.O 3177 – I, S. J. Sibal, Chief Inspector of Mines and also designated as Directorate General of Mines Safety, under the powers conferred on me under sub-section 3 of Section 6 of the Mines Act, 1952, and in supersession of all the previous notifications and all circulars issued on this subject, hereby declare the area of jurisdiction of Zones, Regions and Sub-Regions with respect to which Inspectors appointed under Sub-section 1 of Section 5 of the Mines Act, 1952 shall exercise their respective powers, as given in the 'appendix' enclosed.

[No. S-29022/1/2009-Genl/3423]
S.J. Sibal, Chief Inspector of Mines & Director General of Mines Safety

Gaziabad Region, HQ at Gaziabad in the State of Uttar Pradesh

Northern Zone with Headquarters at Gaziabad (Uttar Pradesh) comprising of Gaziabad Region, Ajmer Region, Gwalior Region and Varanasi Region.

Northern Western Zone with Headquarters at Udaipur (Rajasthan) comprising of Ahmedabad Region, Udaipur Region, and Surat Region

Ahmedabad Region, HQ at Ahmedabad in the State of Gujrat

State of Gujrat	All Mines in the districts of Kutch, Patan, Jamnagar, Porbandar, Rajkot, Junagarh, Amreli, Bhavnagar, Surendra Nagar, Ahmedabad, Anand, Kheda, Gandhinagar & Mehsana
Union Territory of Daman, Diu, Dadra & Nagar Haveli	All Mines in Diu

Udaipur Region, HQ at Udaipur in the State of Rajasthan

State of Rajasthan	All Mines in the districts of Jalor, Sirohi, Rajsamand, Udaipur, Dungarpur, Chittorgarh, Pratapgarh, Banswara
State of Madhya Pradesh	All Mines in the districts of Neemach, Mandsaur, Ratlam, Ujjain, Shajapur, Dewas & Indore
State of Gujrat	All Mines in the districts of Banaskantha & Sabarkantha

Surat Region, HQ at Surat, in the State of Gujrat

State of Gujrat	All Mines in the districts of Panchmahal, Dahod, Vadodra, Bharuch, Narmada, Surat, Navsari, Valsad & Dangs
State of Madhya Pradesh	All Mines in the districts of Jhabua, Dhar, West Nimar, East Nimar & Badwani
State of Maharashtra	All Mines in the districts of Nandurbar, Dhule, Nasik & Jalgaon
Union Territory of Daman, Diu,	All Mines in Daman, Dadra & Nagar Haveli

Dadra & Nagar Haveli

Western Zone with Headquarters at Nagpur (Maharashtra) comprising of Nagpur Region 1, Nagpur Region 2, Jabalpur Region, and Bilaspur Region

Nagpur Region No.1, HQ at Nagpur in the State of Maharashtra (including Parasia Sub Region)

State of Madhya Pradesh	All Mines in the districts of Betul, Chindwara, Seoni & Balaghat
State of Maharashtra	All Mines in the districts of Akola, Amravati, Wardha, Nagpur, Bhandara & Gondia

Parasia Sub Region, HQ at Parasia in the State of Madhya Pradesh

State of Madhya Pradesh	All Mines in the district of Chindwara

Nagpur Region No.2, HQ at Nagpur in the State of Maharashtra

State of Maharashtra	All Mines in the districts of Buldana, Washim, Yavatmal, Chandrapur, Garhchiroli, Aurangabad, Jalna, Hingoli, Beed, Parbhani, Nanded, Osmanabad & Latur

Jabalpur Region, HQ at Jabalpur in the State of Madhya Pradesh

State of Madhya Pradesh	All Mines in the districts of Rewa, Satna, Panna, Damoh, Katni, Umaria, Shahdol, Anuppur, Sagar, Jabalpur, Mandla, Dindori, Raisen, Narsingpur & Sihore

Bilaspur Region, HQ at Bilaspur in the State of Chhattisgarh

State of Chhattisgarh	All Mines in the districts of Korea, Korba, Bilaspur, Kawardha, Rajnandgaon, Durg, Raipur, Dhamtari, Kanker, Bastar & Dantewada

South Central Zone with Headquarters at Hyderabad (Andhra Pradesh) comprising of Hyderabad Region 1, Hyderabad Region 2, and Goa Region

Hyderabad Region No.1, HQ at Hyderabad in the State of Andhra Pradesh

State of Andhra Pradesh	All Mines in the districts of Karimnagar, Warangal, Khammam, Krishna, West Godavari, East Godavari, Visakhapatnam, Vizianagaram & Srikakulam

Hyderabad Region No.2, HQ at

Hyderabad in the State of Andhra Pradesh, (including Nellore Sub Region)

State of Andhra Pradesh	All Mines in the districts of Adilabad, Nizamabad, Medak, Rangareddy, Hyderabad, Nalgonda, Mahboobnagar, Guntur, Prakasam, Cuddappah & Nellore
State of Karnataka	All Mines in the districts of Bidar & Gulbarga

Nellore Sub Region, HQ at Nellore in the State of Andhra Pradesh

State of Andhra Pradesh	All Mines in the districts of Guntur, Prakasam, Cuddappah & Nellore

Goa Region, HQ at Madgaon in the State of Goa

State of Goa	All Mines
State of Karnataka	All Mines in the districts of Bijapur, Belgaum, Dharwad, & Uttar Kannad
State of Maharashtra	All Mines in the districts of Thane, Ahmadnagar, Raigarh, Mumbai, Pune, Satara, Ratnagiri, Solapur, Sangli, Kolhapur, & Sindhudurg

Southern Zone with Headquarters at Begaluru (Karnataka) comprising of Bengaluru Region, Bellary Region, and Chennai Region

Bengaluru Region, HQ at Bengaluru in the State of Karnataka

State of Karnataka	All Mines in the districts of Shimoga, Udipi, Chikmaglur, Dakshin Kannad,Chitradurga, Tumkur, Hassan, Kolar, Bangaluru, Mandya, Mysore & Chamraj Nagar
State of Tamil Nadu	All Mines in the districts of Krishnagiri, Salem, Erode, Coimbatore & Nilgiris
State of Kerela	All Mines
UT of Lakshadweep Islands	All Mines

Bellary Region, HQ at Bellary in the State of Karnataka

State of Andhra Pradesh	All Mines in the districts of Kurnool & Anantapur
State of Karnataka	All Mines in the districts of Raichur, Koppal, Bellary, Devangere, Bagalkot, Haveri & Gadag

Chennai Region, HQ at Chennai in the State of Tamil Nadu

State of Andhra Pradesh	All Mines in the district of Chittoor
State of Tamil Nadu	All Mines in the districts of Kanchipuram, Vellore, Trichy, Tiruvannamalai, Villupuram, Cuddalore, Ariyalur, Karur, Perambalur, Puddukotai, Dindigul, Sivaganga, Madurai, Theni, Virudhnagar, Tuticorn, Tiruneveli, Kanyakumari, Tiruvallur, Thanjavur, Thiruvanur, Nagapattinam & Ramanathapuram
Union Territory of Pudhuchery	All Mines

Southern Easten Zone with Headquarters at Ranchi (Jharkhand) comprising Of Ranchi Region, Chaibasa Region, Raigarh Region and Bhubaneswar Region

Ranchi Region, HQ at Ranchi in the State of Jharkhand (including Ramgarh Sub Region)

State of Jharkhand	All Mines in the districts of Garhwa, Palamu, Chatra, Latehar, Lohardaga, Gumla, Simdega, Ranchi, Ramgarh & Hazaribag

Ramgarh Sub Region, HQ at Ramgarh in the State of Jharkhand

State of Jharkhand	All Mines in the districts of Ramgarh & Hazaribag

Chaibasa, HQ at Chaibasa in the State of Jharkhand

State of Jharkhand	All Mines in the districts of East Singhbhum, West Singhbhum & Saraikela Kharsawan
State of Orissa	All Mines in the districts of Sundergarh, Mayurbhanj & Keonjhar excluding Anandpur Division

Raigarh Region, HQ at Raigarh in the State of Chattisgarh

State of Chattisgarh	All Mines in the districts of Raigarh, Jashpur, Surguja, Janjgir & Mahasamand

Bhubaneswar Region, HQ at Bhubaneswar in the State of Orissa

State of Orissa	All Mines in the districts of Jharsuguda, Sambalpur, Deoghar, Angul, Dhenkanal, Jajpur, Keonjhar (Anandpur Division only), Bhadrak, Baleswar, Kendrapara, Jagatsinghpur, Cuttack, Khurda, Puri, Nayagarh, Boudh, Bargarh, Sonepur, Nuapara, Bolangyr, Phulbani, Ganjam, Gajapati, Rayagada, Kalahandi, Navrangpur, Koraput & Malkangiri

Easten Zone with Headquarters at Sitarampur (W.B.) comprising of Sitarampur Region I, Sitarampur Region II, Sitarampur Region III, and Guwahati Region

Sitarampur Region I, HQ at Sita-rampur in the State of West Bengal

State of Jharkhand	All Mines in the districts of Jamtara & Dumka
State of West Bengal	All mines in the District of Burdwan situated south of GT Road and bounded by Burnpur Road leading from GT Road on the east & Neamatpur, Radhanagar & Chinakuri Ghat Road on the west. All mines in the District of Burdwan situated in the area bound by GT Road on the south, road leading from Andal turning on GT road to Khandra, Ukhra, Haripur, Krishnagaar, Jamuria & Chanda

	More on GT road

Sitarampur Region II, HQ at Sita-rampur in the State of West Bengal

State of West Bengal	All Mines in the districts of Burdwan exept those included in Sitarampur Region No.I & Sitarampur Region No.III All Mines in the districts of Purulia, Bankura, Birbhum, Murshidabad, Nadia, North 24 Parganas, South 24 Parganas, Howrah, Hoogli & Mednipur
Union Territory of Andaman & Nicobar Islands	All Mines

Sitarampur Region III, HQ at Sita-rampur in the State of West Bengal

State of Jharkhand	All Mines in the districts of Godda, Deoghar, Pakur & Sahebganj
State of West Bengal	All Mines in the district of Burdwan situated on the south of GT Road except those included in Sitarampur Region No. I. All mines in the District of Burdwan bounded by road leading from Pandaveswar Ghat to Haripur, Krihnanagar, Jamuria & Darbardanga

Guwahati Region, HQ at Guwahati in the State of Assam

State of Assam	All Mines
State of Arunachal Pradesh	All Mines
State of Manipur	All Mines
State of Mizoram	All Mines
State of Meghalaya	All Mines
State of Nagaland	All Mines
State of Tripura	All Mines
State of Sikkim	All Mines
State of West Bengal	All Mines in the districts of Jalpaiguri, Uttar Dinajpur, Darjeeling, Cooch Bihar, Dakshin Dinajpur, & Malda
State of Bihar	Oil pipeline and its installations extending from Oil fields in the State of Assam up to refineries situated in the State

Central Zone with Headquarters at Dhanbad (Jharkhand) comprising of Dhanbad Region I, Dhanbad Region II, Dhanbad Region III, and Koderma Region

Dhanbad Region I, HQ at Dhanbad in the State of Jharkhand

State of Jharkhand	All Mines in the district of Dhanbad lying in the area bound by NH 32 starting at Gobindpur upto Mohuda More on eastern and southern sides, Rajganj-Mohuda More road on the Western Side and, NH 2 between Gobindpur and Rajganj on the northern side, All Mines in the district of Dhanbad lying in the area bound by Kari Jore, road connecting Buragarh & Pootki and NH 32 All mines in the district of Dhanbad lying in the area north of NH 2 and west of Giridih – Tundi – Gobindpur road.

Dhanbad Region II, HQ at Dhanbad in the State of Jharkhand	
State of Jharkhand	All Mines in the district of Dhanbad lying east of Giridih – Tundi – Gobindpur road and lying east of Dhanbad – Jharia – Jealgora – Mohulbani Road.
Dhanbad Region II, HQ at Dhanbad in the State of Jharkhand	
State of Jharkhand	All Mines in the district of Dhanbad except those included in Dhanbad Region No.I and Dhanbad Region No.II All Mines in the district of Bokaro except those included in Koderma Region
Koderma Region, HQ at Koderma in the State of Jharkhand	
State of Bihar	All Mines
State of Jharkhand	All Mines in the districts of Koderma & Giridih All mines situated in the district of Bokaro lying west of Hirak Ring road and all mines lying west of NH 32 & south of Chas – Chandankyari – Rangnathpur Road

New Delhi, the 04th May, 2009

G.S.R. 60. – In pursuance of the provisions of Regulation 13(4) of the Metalliferous Mines Regulations, 1961, the bye-laws for the conduct of examination and grant of Manager's Certificates of Competency restricted to mines having Opencast workings only so far as they relate to Syllabus for Examination, for First Class Manager's Certificate (Appendix – I) and for Second Class Manager's Certificate (Appendix – II) is being substituted by the following :-

APPENDIX – I

SYLLABUS FOR EXAMINATION FOR FIRST CLASS MANAGER'S CERTIFICATE OF COMPETENCY RESTRICTED TO MINES HAVING OPENCAST WORKING ONLY

(Under Metalliferous Mines Regulations, 1961)

(a) Winning and Working

Geology :- Characteristics and classification of mineral deposits; application of geology to mining; geological structures; folds, faults, fractures, fissures etc. methods of exploration and delineation of the ore bodies; boring through disturbed strata; bore hole survey; sampling; estimation of cut-off grade and ore reserve; losses of mineral in mining; net smelter return (NSR) to mill and mine; mine valuation; quality control, interpretation of geological maps.

Opencast Mining: Opencast of deposits and preparation for excavation; box cut, types; selection of site; formation of production benches; ripping; types of rippers; concept of rippability and cycle of operation; drilling; blast hole drills; performance parameters; requirement of number of drills; blasting; blast design; factors influencing blast design; deep hold blasting; calculation of charge per hole; ground vibration;

secondary blasting and problems of blasting side casting; environment friendly non-blasting techniques; safety aspects.

Discontinuous/cyclic methods of excavation and transport; shovel dumper operation; applicability of electric shovel and hydraulic excavators; cycle time and productivity calculation; estimation of equipment fleet; dragline operation; side casting; side cast diagram; calculation of reach; cycle time; productivity calculation; bucket capacity requirement; scrappers; types; methods of work; push pull operation etc., bucket wheel excavator; operational methods (lateral block, half block and full block etc.,) productivity calculation; continuous surface miner; operational methods (wide/full base methods, wide/full bench, block mining, stepped cut, empty travel back, turn back and continuous mining methods); conveyors; shiftable and high angle conveyors; mode of operation etc;, OITDS (operator independent truck dispatch system); in-pit crushing and strip-mining; safety aspect.

Application of concepts of Rock Mechanics for designing the methods of mining and strata control; Design and stability of structures in rock; design of support and reinforcement for open pits; rock bolts, cable bolts; wire mesh; monitoring of rock mass performance, mechanics of rock fragmentation; slope stability; slope angle, benches, berms, factors affecting slope stability, design criteria and monitoring systems; dump stability; dump management.

Use and safe handling of explosives; blasting techniques and their relative efficiency; total cost concept safety precautions.

Sources of danger from water; precautions to prevent inundation; water dams; water danger plans.

Application of numerical modeling in mine design application of computers in mine design and operational controls.

(b) Mining Machinery

Strength of materials; applied mechanics; fluid mechanics.

Theory of Machines :- Machine design, different types of gears and drives, bearing, collars and joints, brakes and friction clutches, governors.

Heat engines, general outline of working principles of steam generators and auxiliary equipment, condensing plant, reciprocating steam engines, turbines, internal combustion engines, conduct of gas, oil and steam engine trial; mechanical efficiency of engines, measurement of indicated and brake horsepower.

Machine tools and workshop processes:-

Material handling equipment in mines; Types, construction and operation; safety devices; maintenance and calculations for rope haulages; locomotives (tractive effort, draw bar pull, ideal gradient), conveyors, systems (belt conveyor, chain conveyor, cable belt conveyor, high angle conveyor, shiftable belt conveyor, pipe conveyor); scraper winches, aerial rope-ways, man riding systems; comminution equipment; in-pit crushers, feeder breaker etc., mine cars, track design and layout; super elevation; track fitting and safety appliances; self acting inclines; ore handling plants; rail wagon loading plants.

Pumps :- Characteristics, motor power, capacity and calculations, laying of water mains, dealing with acid water; slurry, drainage; lodgements, storage, designs and layout of dams, sumps, pumping problems.

Opencast machinery :- Constructions, function and operation of blast hole drills, rippers, scrapers, shovels; draglines, dumpers, road graders, dozers, wheel loaders; bucket wheel excavators; spreaders; surface continuous miners and their maintenance aspects.

Mine electrical engineering :- Transmission and distribution of electrical power in mines; radial and ring main distribution; sub-station arrangements; short transmission lines; cables; switch gears and protective devices; protective relays; circuit breakers; gate-end box; drill panel; field switch; transwitch; symmetrical fault and circuit breaker rating; mine signaling; power economics; industrial tariffs; power factor improvement; electrical drives and semiconductor controllers; selection of motors and starters; semiconductor devices; principles of operation of thyristor controlled variable speed electrical drives; electrical breaking; earthing; flameproof enclosures; use of high voltage operational equipment in mines.

Generation, transmission and utilization of power, steam, electricity and compressed air; air compressor and auxiliary equipment; air turbines and air engines; efficiency of power, electricity and steam systems; safety aspects.

Automation in mines :- Armchair mining (tele-operations of mining equipments)

Maintenance Systems :- Monitoring and reporting tribology – corrosion, planned maintenance, Preventive, periodical and total maintenance systems in mines. Condition based monitoring and related maintenance system.

(c) Mine Surveying

Linear measurement :- Instruments for measuring distance and ranging, units of measurement in surveying.

EDM :- Principles of measurements; types; correction and selection of instrument.

Angular measurement :- Prismatic compass; bearing of lines; local attraction; magnetic declination.

Dials; loose and fast needle surveying; plan table surveying and micro-optic alidade.

Theodolite :- Modern micro-optic theodolites; measurement of horizontal and vertical angles; theodolite traversing; traverse calculation; computation of coordinates; adjustment of traverse; temporary and permanent adjustment; tacheometry.

Lavelling :- Lavelling instruments; types of leveling; characteristics and uses of contours; methods of contouring; booking and reduction methods; temporary and permanent adjustment of levels; problems solving.

Use, care, testing and adjustment of instruments.

Controlled surveys :- Triangulation; trilateration; application of GPS and Total Station in mine surveying.

Field astronomy :- Astronomical terms; determination of true bearing by equal altitude method; Gyro theodolite; principle and determination of Gyro north.

Surveys of flat, moderately and steeply inclined and vertical workings; traversing along steep working with or without auxiliary telescopes; 3D laser profiling of bench walls in opencast working.

Theory of errors and adjustments: Causes and classification of errors; inclines of precision; laws of weight propagation and adjustment of errors; adjustment of triangulation figures.

National grid : Map projection Cassini Lambert's polyconic and universal transfers Mercator; transformation of coordinates.

Geodesy :- Geod, spheroid and ellipsoid, geocentric, geodetic and astronomical coordinates, orthometric and dynamic heights.

Astronomy :- Astronomical triangle; conversion of time systems and precise determination of azimuth by astronomical methods.

Photogrammetry :- Introduction; scale of a vertical photograph; photograph versus maps; application of photogrammetry in mining.

Area and volume calculation :- Different methods and their limitations; earth work and building estimation; laying out of rail and haul road curves.

Sampling, and valuation of mineral deposits; reserve calculations.

Dip, strike, fault and outcrop problems, borehole surveying and calculations, determination of azimuth, latitude and longitude.

Types of plans and sections for opencast workings and their preparation, care, storage and preservation; legislation concerning mine plans and sections; duties and responsibilities of surveyors.

Application of computers in mine surveying and preparation of plans.

(d) Mine Management : Legislation : Environmental Management and General Safety.

Mine Management :-

Introduction :- Evolution of management; theory and practice; principles of scientific management; elements of management function; planning; organization and control; structure and design of organization for mining enterprises.

Personal Management :- Selection; training and development of human resources for mining enterprises; leadership; study of traditional leader traditional; autocratic; democratic and Laissez-Faire behaviors.

Production Management :- Determination of norms and standards of operations by work study, analysis of mine capacities and capability; production planning, scheduling and control; short term and long term planning; productivity; concepts and measurements; application of Ergonomics in mine operation.

Financial Management :- Capital budgeting; techniques for mining project; project evaluation; payback period and IRR; methods of cost analysis and cost control; breakeven charts; working capital management.

Mining Environment:- EIA (Environment Impact Assessment), EMP (Environment Management Plan), ETP (Effluent Treatment Plant), STP (Sewerage Treatment Plant), threat to environment from underground and surface mining, means of mitigation, treatment of pollutants, monitoring systems, water management; mine closure plan; R&R (rehabilitation and re-settlement).

Economic Impact of Mining Economics of mining effect on community – before, during and after mining.

Materials Management for mining sector.

Behavioural Sciences for Management :- Conflict management; conflict in organization; sources of conflict; dealing with conflict; organizing for conflict resolution; conflict and growth; Individual motivation; two way personal communication.

Industrial Accident :- Study of human factors of industrial accidents; their causes and remedies.

Mine Legislation :-

Health and Safety Laws :- The Mines Act, 1952; Mines Rules 1955, Metalliferous Mine Regulation, 1961, Mines Rescue Rules, 1985, provisions of Indian Electricity Rules, 1956 applicable to mines; Mine Vocational Training Rules, 1966, other rules and legislation as applicable to opencast metalliferous mines.

General Safety in Mines

Safety in Mines :- Duty of care; occupational hazards of mining; causes and prevention; accidents and their classification; accident statistics; frequency rate an

severity rates; cause-wise analysis, basic causes of accident occurrence; investigation into accidents and accident report; in-depth study into various causes of accidents measures for improving safety in mines; TRAP (take responsibility in accident prevention); cost of accident; safety management system; contribution of human elements in mine safety, workers participation in safety management; ISO and safety audit; safety conferences; tripartite and bipartite committees; role of information technology in safety management.

Risk Management :- Theory and application, baseline, continuous and issue based risk assessment, how they are applied to technical areas, risk management techniques, means of managing (minimizing or eliminating) risk, computer application and simulations, manager's role in risk management, due diligence, application of risk assessment and risk management with reference to due diligence.

Disaster management :- Emergency services, equipments and procedures, emergency control rooms, rescue and recovery; procedure and responsibilities, safety of persons engaged in emergency response, investigations and reports; assessment of damage, mine rescue; mine gases and their physiological effects; rescue equipments; resuscitation and reviving apparatus; selection and training for rescue work.

First aid and ambulance work.

Notified and occupational diseases; silicosis and pneumoconiosis, physiological aspects of breathing in dust laden atmosphere; dust sampling and sampling instruments; methods of counting and analysis; other mines diseases and their symptoms; preventions and treatment.

Lighting :- General principles of artificial lighting; lighting standards and their assessment.

Sanitation and health in mines.

Safety related issues in mineral beneficiation and transport.

APPENDIX – II
SYLLABUS FOR EXAMINATION FOR SECOND CLASS MANAGER'S CERTIFICATE OF COMPETENCY RESTRICTED TO MINES HAVING OPENCAST WORKING ONLY
(Under Metalliferous Mines Regulations, 1961)

(a) Winning and Working

Geology :- Characteristics and classification of mineral deposits;. exploration and delineation of the ore bodies; boring through disturbed strata; bore hole survey; geological structures; folds, faults, fractures, fissures etc interpretation of geological maps.

Opencast Mining: Opencast of deposits; preparation for excavation; box cut, types; site selection; formation of benches; ripping; rippability; types of rippers; cycle of operation; drilling; blast hole drills; performance parameters; requirement of number of drills; blasting; blast design; factors influencing blast design; deep hold blasting; calculation of charge per hole; ground vibrations; secondary blasting and related problems; non-blasting techniques; safety aspects.

Methods of excavation and transport :- Shovel dumper operation; electric shovel and hydraulic excavators; cycle time and productivity calculation; estimation of equipment fleet; dragline operation; side casting; calculation of reach; cycle time; productivity calculation; bucket capacity requirement; scrappers; bucket wheel excavator; (lateral block, half block and full block method etc.,) productivity calculation; continuous surface miner; operational methods (wide/full base, wide/full

bench, block mining, stepped cut, empty travel back, turn back and continuous mining methods); conveyors; shiftable and high angle conveyors; in-pit crushing and strip-mining; operator independent truck dispatch system, safety aspect.

Application of concepts of Rock Mechanics for designing the methods of mining and strata control; Design and stability of structures in rock; design of support and reinforcement for open pits; rock bolts, cable bolts; wire mesh; monitoring of rock mass performance, mechanics of rock fragmentation; slope stability; slope angle, benches, berms, factors affecting slope stability, dump stability; dump management.

Use and safe handling of explosives; blasting techniques and their relative efficiency; total cost concept safety precautions.

Sources of danger from water; precautions to prevent inundation; water dams; water danger plans.

(b) Mining Machinery

Strength of materials; Applied mechanics; Fluid mechanics.

Theory of Machines :- Machine design, different types of gears and drives, bearing, collars and joints, brakes and friction clutches, governors.

Heat engines, general outline of working principles of steam generators and auxiliary equipment, condensing plant, reciprocating steam engines, turbines, internal combustion engines, conduct of gas, oil and steam engine trials; mechanical efficiency of engines, measurement of indicated and brake horsepower.

Machine tools and workshop processes:-

Material handling equipment in mines; Types, construction and operation; safety devices; maintenance and calculations for rope haulages; locomotives (tractive effort, draw bar pull, ideal gradient), conveyors, systems (belt conveyor, chain conveyor, cable belt conveyor, high angle conveyor, shiftable belt conveyor, pipe conveyor); scraper winches pumps, (Characteristics, motor power, capacity and calculations) aerial rope-ways, man riding systems; in-pit crushers, feeder breaker etc., mine cars, track design and layout; super elevation; track fitting and safety appliances; self acting inclines; ore handling plants; rail wagon loading plants; comminuation equipment; laying of water mains; dealing with acid water; drainage lodgements.

Opencast machinery :- Constructions, function and operation of blast hole drills, rippers, scrapers, shovels; draglines, dumpers, road graders, dozers, wheel loaders; bucket wheel excavators; spreaders; surface continuous miners and their maintenance aspects.

Mine electrical engineering :- Transmission and distribution of electrical power in mines; radial and ring main distribution; sub-station arrangements; short transmission lines; cables; switch gears and protective devices; protective relays; circuit breakers; gate-end box; drill panel; field switch; trans witch; symmetrical fault and circuit breaker rating; mine signaling; power economics; industrial tariffs; power factor improvement; electrical drives and semiconductor controllers; selection of motors and starters; semiconductor devices; principles of operation of thyristor controlled variable speed electrical drives; electrical breaking; earthing; flameproof enclosures; and intrinsic safety; use of high voltage operational equipment in mines.

Generation, transmission and utilization of power, steam, electricity and compressed air in mines; safety aspects.

Automation in mines :- Armchair mining (tele-operations of mining equipments)

Preventive, periodical and total maintenance systems in mines.

(c) Mine Surveying

Linear measurement :- Instruments for measuring distance and ranging, units of measurement.

EDM :- Principles of measurements; types; correction and selection of instrument.

Angular measurement :- Prismatic compass; bearing of lines; local attraction; magnetic declination.

Dials; loose and fast needle surveying; plane table surveying and micro-optic alidade.

Theodolite :- Modern micro-optic theodolites; measurement of horizontal and vertical angles; theodolite traversing; traverse calculation; computation of coordinates; adjustment of traverse; temporary and permanent adjustment; Gyro theodolite; principle and determination of Gyro north; determination of true bearing by equal altitude method; tacheometry.

Levelling :- Levelling instruments; types of leveling; characteristics and uses of contours; methods of contouring; booking and reduction methods; temporary and permanent adjustment of levels.

Use, care, testing and adjustment of instruments.

Controlled surveys :- Triangulation; trilateration; application of GPS and Total Station in mine surveying.

Surveys of flat, moderately and steeply inclined and vertical workings; traversing along steep working with or without auxiliary telescopes; 3D laser profiling of bench walls in opencast working.

Theory of errors and adjustments: Causes and classification of errors; indices of precision; laws of weight propagation and adjustment of errors; adjustment of triangulation figures.

National grid : Map projection Cassini Lambert's polyconic and universal transfers Mercator; transformation of coordinates.

Astronomy :- Astronomical triangle; conversion of time systems and precise determination of azimuth by astronomical methods.

Area and volume calculation :- Different methods and their limitations; earth work and building estimation; laying out of rail and haul road curves.

Sampling, and reserve calculations.

Dip, strike, fault and outcrop problems, borehole surveying and calculations.

Types of plans and sections for opencast workings and their preparation, care, storage and preservation; legislation concerning mine plans and sections; duties and responsibilities of surveyors.

Application of computers in mine surveying and preparation of plans.

(d) Mine Management : Legislation : Environmental Management and General Safety.

Mine Management :-

Introduction :- Principles of scientific management; management functions; planning; organization and control; structure of organization for mining enterprises.

Personal Management :- Selection; training and development of human resources; conflict management; sources of conflict; dealing with conflict, motivation and two way personal communication.

Production Management :- Production planning; scheduling and control; short term and long term planning; productivity; concepts and measurements.

Environmental Management :- Mine environment monitoring and control, EMP; mine closure plan; R&R (rehabilitation and re-settlement).

Mine Legislation :-

Health and Safety Laws :- The Mines Act, 1952; Mines Rules 1955, Metalliferous Mine Regulation, 1961, Mines Rescue Rules, 1985, Provisions of Indian Electricity Rules, 1956 applicable to mines; Mine Vocational Training Rules, 1966, other rules and legislation as applicable to opencast metalliferous mines.

General Safety in Mines

Safety in Mines :- Causes and prevention; and their classification; frequency rate an severity rates; cause-wise analysis, investigation into accidents and accident report; in-depth study into various causes of accidents; measures for improving safety in mines; risk assessment and risk management; cost of accident; safety management system; human elements in mine safety; workers participation in safety management; ISO and safety audit; safety conferences; tripartite and bipartite committees.

Disaster management :- rescue and recovery; investigations and reports; investigation after surface mine fires; fire lighting plan.

First aid and ambulance work.

Silicosis and pneumoconiosis, physiological aspects of breathing in dust laden atmosphere; dust sampling and sampling instruments; methods of counting and analysis; other mines diseases and their symptoms; preventions and treatment.

Lighting :- General principles of artificial lighting; lighting standards and their assessment.

Sanitation and health in mines.

Safety related issues in mineral beneficiation and transport.

[No.Board/Metal/944/2009]

M.M. SHARMA, Director General of Mines Safety &
Chairman, Board of Mining Examination (Metal)

New Delhi, the 04th May, 2009

G.S.R. 61. – In pursuance of the provisions of Regulation 13(4) of the Metalliferous Mines Regulations, 1961, the bye-laws for the conduct of examination and grant of Surveyors Certificates of Competency restricted to mines having Opencast workings only so far as they relate to Syllabus for Examination, (Appendix – I) is being substituted by the following :-

APPENDIX – I

SYLLABUS FOR EXAMINATION FOR MINES SURVEYORS CERTIFICATES OF COMPETENCY RESTRICTED TO MINES HAVING OPENCAST WORKING ONLY

(Under Metalliferous Mines Regulations, 1961)

Linear measurement :- Instruments for measuring distance and ranging, chain surveying; errors in chaining and plotting; optical square.

EDM :- Principles of measurements; types; correction and selection of instrument.

Angular measurement :- Prismatic compass; bearing of lines; local attraction; magnetic declination.

Plan Table Surveying; methods contouring using plane table and micro-optic alidade.

Miners' dials and other compass instruments; dialing; loose and fast needle surveying.

Theodolite :- Modern micro-optic theodolites; measurement of horizontal and vertical angles; theodolite traversing; traverse calculation; computation of coordinates; adjustment of traverse; temporary and permanent adjustment.

Levelling :- Levelling instrument types of leveling; booking and reduction methods; temporary and permanent adjustment of levels; geometrical, trigonometric and physical leveling; characteristics and uses of contours; methods of contouring; traverse; co-ordinates and leveling problems.

Tachometry:- Controlled surveys :- Triangulation; trilateration; application of GPS and Total Station in mine surveying.

Use, care, testing, and adjustments of instruments.

Field astronomy :- Astronomical terms; determination of true bearing by equal altitude method; Gyro theodolite; principle and determination of Gyro north.

National grid : Map projection Cassini Lambert's polyconic and universal transfers Mercator; transformation of coordinates, vertical projections; mine models.

Geodesy :- Geod, spheroid and ellipsoid, geocentric, geodetic and astronomical coordinates, orthometric and dynamic heights.

Astronomy :- Astronomical triangle; conversion of time systems and precise determination of azimuth by astronomical methods.

Photogrammetry :- Introduction; scale of a vertical photograph; photograph versus maps; application of photogrammetry in mining.

Theory of errors and adjustments: Causes and classification of errors; inclines of precision; laws of weight propagation and adjustment of errors; adjustment of triangulation figures.

Traversing along steep topography with or without auxiliary telescope.

Area and volume calculation; different methods and their limitations; earth work and building estimation; laying out of rail and haul road curves; determination of azimuth latitude and longitude.

Borehole surveying and calculations; dip, strike, outcrop and fault problems.

Development sampling :- Channel and block averaging milling widths; observe plans.

Types of plans for opencast workings; their preparation, care, storage and preservation; legislation concerning mine plans and sections; duties and responsibilities of surveyors.

Geogological map reading.

Application of computers in mine surveying and preparation of plans. 3D laser profiling of bench walls in opencast mine.

[No.Board/Metal/945/2009]

M.M. SHARMA, Director General of Mines Safety &
Chairman, Board of Mining Examination (Metal)

New Delhi, the 04th May, 2009

G.S.R. 62. – In pursuance of the provisions of Regulation 13(4) of the Metalliferous Mines Regulations, 1961, the bye-laws for the conduct of examination and grant of Foremans Certificates of Competency restricted to mines having Opencast workings only so far as they relate to Syllabus for Examination, (Appendix – II) is being substituted by the following :-

APPENDIX – II
SYLLABUS FOR EXAMINATION FOR MINES FORMAN'S CERTIFICATES OF COMPETENCY RESTRICTED TO MINES HAVING OPENCAST WORKING ONLY
(Under Metalliferous Mines Regulations, 1961)

(a) General Safety and Legislation

Duties and responsibilities of workmen, competent persons and officials (excluding managers, assistant managers); discipline amongst workers and control of staff.

Provisions of the Metalliferous Mines Regulations, 1961, relating to mine working; explosives and blasting; haulage; precautions against danger from fire, dust, gas and water and of other provisions and Rules, the enforcement of and compliance with which is the responsibility of mine foremen.

Writing of reports required to be made by mine foreman under the regulations.

Dangerous occurrences in mines and dealing with the same; accidents, their causes and preventions; accident reports; not disturbing the place of accident.

First Aid.

Sanitation and health; miners' diseases, their symptoms and preventions.

(b) Methods of Working.

Nature of occurrence of mineral deposits; geological disturbances and their effects on working conditions; dangers and precautionary measures while approaching geological disturbances.

The purposes and utility of boreholes in estimation and proving mineral reserves.

Opencast methods of mining; mechanized and manual methods; deep hole drilling and blasting; shovel and dumpers; dragline; bucket wheel excavators; surface continuous miner; benching; maintenance of haul roads; other safety precautions; methods of reclamation; dump management.

Suppression and treatment, sampling and analysis of mine dust.

Safe handling and use of explosives; deep hole drilling and blasting; safety precautions.

Sources of danger from surface water; precaution to prevent inundation and irruption of water; water dams water danger plans.

Gates and fencing, different kind of fences.

Inspection of opencast workings.

Reading of statutory plans.

(c) Elements of Mining Machinery.

Safety aspects and safe use of different kinds of machinery used in mines e.g. blast hole drills, rippers; scrappers; shovels; draglines; dumpers; road graders; dozers; wheel loaders; bucket wheel excavators; spreaders; surface continuous miners; brakes (including service and parking brakes); generation and use of compressed air; use of steam and internal combustion engines in mines.

Use of electricity in mines; safety precautions.

Haulage and transport; types of haulage; rope haulage and locomotives; self-acting haulages; haulage roads; rails and tracks; their maintenance and inspection; tubs; signaling; safety devices; codes of practices; traffic rules; unsafe practices; derailments.

Different types of pumps; principles and use of siphons; drainage and water lodgments.

Code of practice for transport, installation, use and shifting of opencast machinery.

Belt conveyors and safety appliances.

[No.Board/Metal/946/2009]

M.M. SHARMA, Director General of Mines Safety &
Chairman, Board of Mining Examination (Metal)

New Delhi, the 04th May, 2009

G.S.R. 63. – In pursuance of the provisions of Regulation 13(4) of the Metalliferous Mines Regulations, 1961, the bye-laws for the conduct of examination and grant of Manager's Certificates of Competency so far as they relate to Syllabus for Examination, for First Class Manager's Certificate (Appendix – I) and for Second Class Manager's Certificate (Appendix – II) is being substituted by the following :-

APPENDIX – I
SYLLABUS FOR EXAMINATION FOR FIRST CLASS MANAGER'S CERTIFICATE OF COMPETENCY
(Under Metalliferous Mines Regulations, 1961)

(a) Winning and Working

Geology :- Characteristics and classification of mineral deposits; application of geology to mining; geological structures; folds, faults, fractures, fissures etc. methods of exploration and delineation of the ore bodies; boring through disturbed strata; bore hole survey; sampling; estimation of cut-off grade and ore reserve; losses of mineral in mining; net smelter return (NSR) to mill and mine; mine valuation; quality control, interpretation of geological maps.

Opening of mineral deposits; Legal requirement about outlets; siting; vertical and inclined shaft; adits; declines; shaft sinking and deepening; methods of sinking; mechanized sinking; in ordinary and water logged grounds, in running sand etc.; freezing, cementation and other special methods; shaft supports, temporary and permanent, tubings etc., recent developments.

Developments and layout of mines including surface and underground arrangements; layout and development of shaft-top and pit-bottom and haulage arrangements.

Underground Mining Methods; Choice of methods of developments and stopping and factors affecting the same; statutory provisions.

Primary and secondary Development; Choice of level interval and back/block length; main haulage drifts and tunnels; high speed drifting; excavation and equipping of grizzly (conventional and mechanized), ore/waste bin, main ore-pass system, underground crushing, loading and hoisting stations, underground service chambers, sump and other subsidiary excavations.

Cross-cut and drifts; raises and winzes; ground breaking; mucking; ventilation and support; extension of track and other services; modern drilling and loading

equipment; Alimark and Jora-lift raising, long-hole and vertical crater retreat (VCR) raising; Raise boring systems; mechanized winzing.

Stopping :- Classification, selection of stopping methods and applicability; slope layouts, stope preparation and production operation ground breaking, mucking, ventilation, supports, haulage and dumping; stopping of narrow and wide ore bodies; mining of parallel veins; open, supported, filled and caving methods; combined systems and special methods; underhand, overhand, breast, long-hole and raise, resuing, room & pillar, sublevel, large diameter blast hole (DTH), cascade, shrinkage, vertical crater retreat, horizontal cut and fill, square set, top slicing, sub-level caving, block caving methods, combined open room, shrinkage and cut-fill and subsequent filling systems; hydraulic, thermal, hydro chemical, bio chemical and nuclear device mining system; design and construction of draw points; mechanics of draw and draw control procedure; recovery and dilution; problems of deep mining and the remedial measure; design and layout of stopes in rock burst prone mines, mining sequence and rationale.

Opencast Mining: Opening of deposits and preparation for excavation; box cut, types; selection of site; formation of production benches; ripping; types of rippers; concept of rippability and cycle of operation; drilling; blast hole drills; performance parameters; requirement of number of drills; blasting; blast design; factors influencing blast design; deep hold blasting; calculation of charge per hole; ground vibration; secondary blasting and problems of blasting side casting; environment friendly non-blasting techniques; safety aspects.

Discontinuous/cyclic methods of excavation and transport; shovel dumper operation; applicability of electric shovel and hydraulic excavators; cycle time and productivity calculation; estimation of equipment fleet; dragline operation; side casting; side cast diagram; calculation of reach; cycle time; productivity calculation; bucket capacity requirement; scrappers; types; methods of work; push pull operation etc., bucket wheel excavator; operational methods (lateral block, half block and full block etc.,) productivity calculation; continuous surface miner; operational methods (wide/full base methods, wide/full bench, block mining, stepped cut, empty travel back, turn back and continuous mining methods); conveyors; shiftable and high angle conveyors; mode of operation etc;, OITDS (operator independent truck dispatch system); in-pit crushing and strip-mining; safety aspect.

Application of concepts of Rock Mechanics for designing the methods of mining and strata control; Theories of ground movement and strata control; stress, strain, uniaxial and tri-axial strength, Poisson's Ratio, Young's Modulus, convergence, elasticity, litho static and hydrostatic pressure; rock mass classification, strength of pillars (crown/rib/sill/post) and shaft pillar; protection of surface structures; design and stability of structures in rock; design of support and reinforcement for underground excavations support resistance, yielding and non-yielding supports, dynamic and static loading, measuring instruments, consolidated and unconsolidated fills, rock bolts, cable bolts, latest developments in mine supports, economics of support design, cost benefit analysis subsidence; caving of rock mass; problems of deep mining; rock burst; monitoring of rock mass performance; mechanics of rock fragmentation; slope stability and dump stability; dump management; roof management.

Use and safe handling of explosives; blasting techniques and their relative efficiency; total cost concept.

Application of numerical modeling in mine design application of computers in mine design and operational controls.

(b) Mine Ventilation, Explosives, Fires and Inundation

Composition of mine atmosphere; Mine gases; generation, properties and effects; sampling and analysis of mine air; flame safety lamp; monitoring of different gases; inflammability of fire damp; fire damp explosions.

Flame safety lamps and their design; use and maintenance; testing of safety lamps; lamp house and organization.

Heat and humidity :- Sources of heat in mines; geothermal gradient; heat flow in deep mines; effects of heat and humidity; psychometrics; computation of thermodynamic properties of mine air; basic modes of heat transfer in mines; methods of calculation of heat flow and temperature rise in mine airways; heat and moisture transfer in stopes; Computation of heat load due to various machines in development working and stopes e.g. drills, road headers/tunnel bores, LHDs, low profile dumpers locomotives, lump breakers, crushers, belt conveyors underground sub-stations, etc,; air cooling and conditioning.

Air flow in mines:- Laws of air flow; resistance of airways; resistance and splitting problems; equivalent orifice; flow control devices; permissible air velocities.

Natural ventilation :- Seasonal variations; calculation of natural ventilation pressure; thermodynamic principles and other short-cut methods.

Mechanical ventilation :- Theory of different fans; characteristics and suitability of fan; selection, testing and output control; fans in series and parallel; reversal of air flow; fan drift, diffuser and evasee; booster and auxiliary fans; ventilation of heading and sinking shafts; standards of ventilation; ventilation calculation.

Ventilation planning :- Ventilation layout; determination of size of shafts and airways; estimation of air quantity requirements; ventilation network analysis; Hardy Cross methods of iterative analysis and application of linear theory; thermodynamic network analysis and computer application; application of numerical modeling; estimation of pressure requirement; ventilation survey; ventilation plans.

Airbone dust :- Generation, dispersion, measurement and control; suppression and treatment of mine dust; sampling and analysis of mine dust.

Mine fires:- Types; causes; detection; prevention and control of mine fires; spontaneous heating; dealing with mine fires; sealing off fire-areas, build-up of extinctive atmosphere; fire fighting organization; reopening of sealed off fire areas.

Firedamp and sulphide dust explosion :- Cause and prevention; stone dust barrier; water barrier and other methods.

Inundation :- Causes and prevention; precautions and techniques of approaching old water logged working; safety boring apparatus; pattern of hole; design and construction of water dams; water lodgements water danger plan.

Recovery of mine after explosion, fires and inundation and investigation after the same; rescue and recovery in mines; rescue apparatus; organization of rescue work; emergency preparedness and response system.

Illumination :- Cap lamps, layout and organization of lamp rooms; standards of illumination; photometry and illumination survey.

Recent development in mine ventilation; use of numerical modeling in ventilation planning.

Risk Assessment and analysis with reference to mine environment, management of environmental risks.

(c) Mining Machinery

Strength of materials; applied mechanics; fluid mechanics.

Theory of Machines :- Machine design, different types of gears and drives, bearing, collars and joints, brakes and friction clutches, governors.

Heat engines, general outline of working principles of steam generators and auxiliary equipment, condensing plant, reciprocating steam engines, turbines, internal combustion engines, conduct of gas, oil and steam engine trial; mechanical efficiency of engines, measurement of indicated and brake horsepower.

Machine tools and workshop processes:-

Wire ropes :- Construction details, applications, mechanical properties, breaking load, factor of safety bending factor, capacity factor, snap length, critical depth inspection; examination and discarding criteria; rope capping and splicing.

Mine winders :- Types and applications components; shaft fitting; drums and sheaves; ropes and guides; drives and control systems; automatic contrivances; brakes; cage; skip; counter weight and suspension arrangement; duty cycle diagram; winder capacity and motor power calculations; equivalent mass of winder installation; safety devices; Installation; examination and testing of winding equipment.

Underground machinery :- Pneumatic and hydraulic drilling hammers, jumbo drills, Roof bolters, quadro bolters, road headers, raise climbers; tunnel, raise and shaft borers, LHDs, LPDTs, booster compressors, DTH and ITH drilling machines.

Material handling equipment in mines; Types, construction and operation; safety devices; maintenance and calculations for rope haulages; locomotives (tractive effort, draw bar pull, ideal gradient), conveyors, systems (belt conveyor, chain conveyor, cable belt conveyor, high angle conveyor, shiftable belt conveyor, pipe conveyor); scraper winches, aerial rope-ways, man riding systems; in-pit crushers, feeder breaker etc., mine cars, track design and layout; super elevation; track fitting and safety appliances; self acting inclines; ore handling plants; use of diesel equipments in underground mines.

Pumps :- Characteristics, motor power, capacity and calculations, laying of water mains, dealing with acid water; slurry, drainage; lodgements, storage, designs and layout of dams, sumps, pumping problems.

Opencast machinery :- Constructions, function and operation of blast hole drills, rippers, scrapers, shovels; draglines, dumpers, road graders, dozers, wheel loaders; bucket wheel excavators; spreaders; surface continuous miners and their maintenance aspects.

Mine electrical engineering :- Transmission and distribution of electrical power in mines; radial and ring main distribution; sub-station arrangements; short transmission lines; cables; switch gears and protective devices; protective relays; circuit breakers; gate-end box; drill panel; field switch; transwitch; symmetrical fault and circuit breaker rating; mine signaling; power economics; industrial tariffs; power factor improvement; electrical drives and semiconductor controllers; selection of motors and starters; semiconductor devices; principles of operation of thyristor controlled variable speed electrical drives; electrical breaking; earthing; flameproof enclosures; use of high voltage operational equipment in mines.

Generation, transmission and utilization of power, steam, electricity and compressed air; air compressor and auxiliary equipment; air turbines and air engines; efficiency of power, electricity and steam systems; safety aspects.

Automation in mines :- Armchair mining (tele-operations of mining equipments)

Maintenance Systems :- Monitoring and reporting tribology – corrosion, planned maintenance, Preventive, periodical and total maintenance systems in mines. Condition based monitoring and related maintenance system.

(d) Mine Surveying

Linear measurement :- Instruments for measuring distance and ranging, units of measurement in surveying.

EDM :- Principles of measurements; types; correction and selection of instrument.

Angular measurement :- Prismatic compass; bearing of lines; local attraction; magnetic declination.

Dials; loose and fast needle surveying; plan table surveying and micro-optic alidade.

Theodolite :- Modern micro-optic theodolites; measurement of horizontal and vertical angles; theodolite traversing; traverse calculation; computation of coordinates; adjustment of traverse; temporary and permanent adjustment; tacheometry.

Lavelling :- Lavelling instruments; types of leveling; characteristics and uses of contours; methods of contouring; booking and reduction methods; shaft depth measurement; temporary and permanent adjustment of levels; problems solving.

Controlled surveys :- Triangulation; trilateration; application of GPS and Total Station in mine surveying.

Field astronomy :- Astronomical terms; determination of true bearing by equal altitude method; Gyro theodolite; principle and determination of Gyro north.

Correlation :- Methods of correlation surface and underground including Gyro-Laser combination.

Development and stone surveys :- Surveys of flat, moderately and steeply inclined and vertical workings; control of direction and gradient in drifts, tunnels, raises and winzes; traversing along steep working with or without auxiliary telescopes; 3D laser profiling of bench walls in opencast working.

Theory of errors and adjustments: Causes and classification of errors; inclines of precision; laws of weight; propagation and adjustment of errors; adjustment of triangulation figures.

National grid : Map projection Cassini Lambert's polyconic and universal transfers Mercator; transformation of coordinates.

Geodesy :- Geod, spheroid and ellipsoid, geocentric, geodetic and astronomical coordinates, orthometric and dynamic heights.

Astronomy :- Astronomical triangle; conversion of time systems and precise determination of azimuth by astronomical methods.

Photogrammetry :- Introduction; scale of a vertical photograph; photographs versus maps; application of photogrammetry in mining.

Area and volume calculation :- Different methods and their limitations; earth work and building estimation; laying out of rail and haul road curves, surface and underground.

Dip, strike, fault and outcrop problems, borehole surveying and calculations.

Types of plans and their preparation, care, storage and preservation; legislation concerning mine plans and sections; duties and responsibilities of surveyors.

Application of computers in mine surveying and preparation of plans.

(e) Mine Management : Legislation : Environmental Management and General Safety.

Mine Management :-

Introduction :- Evolution of management; theory and practice; principles of scientific management; elements of management function; planning; organization and control; structure and design of organization for mining enterprises.

Personal Management :- Selection; training and development of human resources for mining enterprises; leadership; study of traditional leader behavior; autocratic; democratic and Laissez-Faire behaviors.

Production Management :- Determination of norms and standards of operations by work study, analysis of mine capacities and capability; production planning, scheduling and control; short term and long term planning; productivity; concepts and measurements; application of Ergonomics in mine operation.

Financial Management :- Capital budgeting; techniques for mining project; project evaluation; payback period and IRR; methods of cost analysis and cost control; breakeven charts; working capital management.

Mining Environment:- EIA (Environment Impact Assessment), EMP (Environment Management Plan), ETP (Effluent Treatment Plant), STP (Sewerage Treatment Plant), threat to environment from underground and surface mining, means of mitigation, treatment of pollutants, monitoring systems, water management; mine closure plan; R&R (rehabilitation and re-settlement).

Economic Impact of Mining Economics of mining effect on community – before, during and after mining.

Materials Management for mining sector.

Behavioural Sciences for Management :- Conflict management; conflict in organization; sources of conflict; dealing with conflict; organizing for conflict resolution; conflict and growth; Individual motivation; two way personal communication.

Industrial Accident :- Study of human factors of industrial accidents; their causes and remedies.

Mine Legislation :-

Health and Safety Laws :- The Mines Act, 1952; Mines Rules 1955, Metalliferous Mine Regulation, 1961, Mines Rescue Rules, 1985, provisions of Indian Electricity Rules, 1956 applicable to mines; Mine Vocational Training Rules, 1966, other rules and legislation as applicable to opencast metalliferous mines.

General Safety in Mines

Safety in Mines :- Duty of care; occupational hazards of mining; causes and prevention; accidents and their classification; accident statistics; frequency rate and severity rates; cause-wise analysis, basic causes of accident occurrence; investigation into accidents and accident report; in-depth study into various causes of accidents measures for improving safety in mines; TRAP (take responsibility in accident prevention); cost of accident; safety management system; contribution of human elements in mine safety, workers participation in safety management; ISO and safety audit; safety conferences; tripartite and bipartite committees; role of information technology in safety management.

Risk Management :- Theory and application, baseline, continuous and issue based risk assessment, how they are applied to technical areas, risk management techniques, means of managing (minimizing or eliminating) risk, computer

application and simulations, manager's role in risk management, due diligence, application of risk assessment and risk management with reference to due diligence.

Disaster management :- Emergency services, equipments and procedures, emergency control rooms, rescue and recovery; procedure and responsibilities, safety of persons engaged in emergency response, investigations and reports; assessment of damage, mine rescue; mine gases and their physiological effects; rescue equipments; resuscitation and reviving apparatus; selection and training for rescue work.

First aid and ambulance work.

Notified and occupational diseases; silicosis and pneumoconiosis, physiological aspects of breathing in dust laden atmosphere; dust sampling and sampling instruments; methods of counting and analysis; other mines diseases and their symptoms; preventions and treatment.

Lighting :- General principles of artificial lighting; lighting standards and their assessment.

Sanitation and health in mines.

Safety related issues in mineral beneficiation and transport.

APPENDIX – II

SYLLABUS FOR EXAMINATION FOR SECOND CLASS MANAGER'S CERTIFICATE OF COMPETENCY

(Under Metalliferous Mines Regulations, 1961)

(a) Winning and Working

Geology :- Characteristics and classification of mineral deposits; exploration and delineation of the ore bodies; boring through disturbed strata; bore hole survey; structural geology; interpretation of geological maps.

Opening of mineral deposits; vertical and inclined shaft; adits; declines; shaft sinking and deepening; methods of sinking; mechanized sinking; in ordinary and water logged grounds, other special methods; shaft supports, temporary and permanent.

Developments and layout of mines including surface and underground arrangements; layout and development of shaft-top and pit-bottom and haulage arrangements.

Underground Mining Methods; Choice of methods of developments and stopping and factors affecting the same; statutory provisions.

Primary and secondary Development; Level interval; block length; main haulage drifts high speed drifting; excavation and equipping of grizzly (conventional and mechanized), ore/waste bin, main ore-pass system, underground crushing, loading and hoisting stations, underground service chambers, sump etc.

Cross-cut and drifts; raises and winzes; ground breaking; mucking; ventilation and support; extension of track and other services; modern drilling and loading equipment; Alimak and Jora-lift raising, long-hole and vertical crater retreat (VCR) raising; Raise boring systems; mechanized winzing.

Stopping :- Classification, selection of stopping methods and applicability; stope layouts, stope preparation; production; operation ground breaking, mucking, ventilation, supports, haulage and dumping; stopping of narrow and wide ore bodies; mining of parallel veins; underhand, overhand, breast, long-hole and raise, resuing, room & pillar, sublevel, large diameter blast hole (DTH), cascade, shrinkage, vertical crater retreat, horizontal cut and fill, square set, top slicing, sub-level caving, block caving methods, combined open room, shrinkage and cut-fill and subsequent filling systems; design and construction of draw points; mechanics of draw and draw control

procedure; recovery and dilution; problems of deep mining and the remedial measure; design and layout of stopes in rock burst prone mines.

Opencast Mining: Opening of deposits; preparation for excavation; box cut, types; site selection; formation of benches; rippability; types of rippers; cycle of operation; drilling; blast hole drills; performance parameters; requirement of number of drills; blasting; blast design; factors influencing blast design; deep hold blasting; calculation of charge per hole; ground vibration; secondary blasting and related problems; non-blasting techniques.

Discontinuous/cyclic methods of excavation and transport; shovel dumper operation; electric shovel and hydraulic excavators; cycle time and productivity calculation; estimation of equipment fleet; dragline operation; side casting; calculation of reach; cycle time; productivity calculation; bucket capacity requirement; scrappers bucket wheel excavator; (lateral block, half block and full block method etc.,) productivity calculation; continuous surface miner; (wide/full base, wide/full bench, block mining, stepped cut, empty travel back, turn back and continuous mining methods); conveyors; shiftable and high angle conveyors; in-pit crushing and strip-mining; safety aspect.

Application of concepts of Rock Mechanics for designing the methods of mining and strata control; Theories of ground movement and strata control; strength of pillars (crown/rib/sill/post) and shaft pillar; protection of surface structures; design and stability of structures in rock; design of support and reinforcement for underground excavations support resistance, yielding and non-yielding supports, dynamic and static loading, consolidated and unconsolidated fills, rock bolts, cable bolts, subsidence; caving of rock mass; problems of deep mining; rock burst; mechanics of rock fragmentation; slope stability and dump stability; dump management; roof management.

Use and safe handling of explosives; blasting techniques and their relative efficiency; total cost concept.

(b) Mine Ventilation, Explosives, Fires and Inundation

Composition of mine atmosphere; Mine gases; generation, properties and effects; sampling and analysis of mine air; flame safety lamp; monitoring of different gases; inflammability of fire damp.

Flame safety lamps; design; use and maintenance; testing of safety lamps; lamp house and organization.

Heat and humidity :- Sources of heat in mines; geothermal gradient; effects of heat and humidity; heat transfer in mines airways and stopes; methods of calculation of heat flow and temperature rise; heat load due to various machines; air cooling and conditioning.

Air flow in mines:- Laws of air flow; resistance of airways; resistance and splitting problems; equivalent orifice; flow control devices; permissible air velocities.

Natural ventilation :- Seasonal variations; calculation of natural ventilation pressure.

Mechanical ventilation :- Mechanical ventilators; characteristics and selection, testing and output control; fans in series and parallel; reversal of air flow; fan drift, diffuser and evasee; booster and auxiliary fans; standards of ventilation; ventilation calculation.

Ventilation planning :- Ventilation layout; determination of size of shafts and airways; estimation of air quantity requirements; ventilation network analysis;

thermodynamic network analysis and computer application; estimation of pressure requirement; ventilation survey; ventilation plans.

Airbone dust :- Generation, dispersion, measurement and control; suppression and treatment of mine dust; sampling and analysis of mine dust.

Mine fires:- Types; causes; detection; prevention and control of mine fires; spontaneous heating; dealing with mine fires; sealing off fire-areas, build-up of extinctive atmosphere; fire fighting organization; reopening of sealed off fire areas.

Firedamp and sulphide dust explosion :- Cause and prevention; stone dust barrier; water barrier and other methods.

Inundation :- Causes and prevention; precautions and techniques of approaching old water logged workings; safety boring apparatus; pattern of hole; design and construction of water dams; water lodgements water danger plan.

Recovery of mine after explosion, fires and inundation and investigation after the same; rescue and recovery in mines; rescue apparatus; organization of rescue work; emergency preparedness and response system.

Illumination :- Cap lamps, layout and organization of lamp rooms; standards of illumination; photometry and illumination survey.

Recent development in mine ventilation.

(c) Mining Machinery

Strength of materials; applied mechanics; fluid mechanics.

Theory of Machines :- Machine design, different types of gears and drives, bearing, collars and joints, brakes and friction clutches, governors.

Heat engines, general outline of working principles of steam generators and auxiliary equipment, condensing plant, reciprocating steam engines, turbines, internal combustion engines, conduct of gas, oil and steam engine trial; mechanical efficiency of engines, measurement of indicated and brake horsepower.

Machine tools and workshop processes:-

Wire ropes :- Construction details, applications, mechanical properties, breaking load, factor of safety bending factor, capacity factor, snap length, critical depth inspection; examination and discarding criteria; rope capping and splicing.

Mine winders :- Types and applications components; shaft fitting; drums and sheaves; ropes and guides; drives and control systems; automatic contrivances; brakes; cage; skip; counter weight and suspension arrangement; duty cycle diagram; winder capacity and motor power calculations; equivalent mass of winder installation; safety devices; Installation; examination and testing of winding equipment.

Underground machinery :- Pneumatic and hydraulic drilling hammers, jumbo drills, Roof bolters, quadro bolters, road headers, raise climbers; tunnel, raise and shaft borers, LHDs, LPDTs, booster compressors, DTH and ITH drilling machines.

Material handling equipment in mines; Types, construction and operation; safety devices; maintenance and calculations for rope haulages; locomotives (tractive effort, draw bar pull, ideal gradient), conveyors (belt conveyor, chain conveyor, cable belt conveyor, high angle conveyor, shiftable belt conveyor, pipe conveyor); aerial rope-ways, man riding systems; in-pit crushers, feeder breaker etc., mine cars, track super elevation; track fitting and safety appliances; self acting inclines; ore handling plants; rail wagon loading plants; use of diesel equipments in underground mines.

Pumps :- Characteristics, motor power, capacity and calculations, laying of water mains, dealing with acid water; slurry, drainage; lodgements, storage, designs and layout of dams, sumps, pumping problems.

Opencast machinery :- Constructions, function and operation of blast hole drills, rippers, scrapers, shovels; draglines, dumpers, road graders, dozers, wheel loaders; bucket wheel excavators; spreaders; surface continuous miners and their maintenance aspects.

Mine electrical engineering :- Transmission and distribution of electrical power in mines; radial and ring main distribution; sub-station arrangements; short transmission lines; cables; switch gears and protective devices; protective relays; circuit breakers; gate-end box; drill panel; field switch; transwitch; symmetrical fault and circuit breaker rating; mine signaling; power factor improvement; electrical drives and semiconductor controllers; selection of motors and starters; semiconductor devices; principles of operation of thyristor controlled variable speed electrical drives; electrical breaking; earthing; flameproof enclosures; use of high voltage operational equipment in mines.

Generation, transmission and utilization of power, steam, electricity and compressed air in mines; safety aspects.

Automation in mines :- Armchair mining (tele-operations of mining equipments)

Preventive, periodical and total maintenance systems in mines.

(d) Mine Surveying

Linear measurement :- Instruments for measuring distance and ranging, units of measurement in surveying.

EDM :- Principles of measurements; types; correction and selection of instrument.

Angular measurement :- Prismatic compass; bearing of lines; local attraction; magnetic declination.

Theodolite :- Modern micro-optic theodolites; measurement of horizontal and vertical angles; theodolite traversing; traverse calculation; computation of coordinates; adjustment of traverse; temporary and permanent adjustment. Gyro theodolite principle and determination of Gyro north; determination of true bearing by equal altitude method; tacheometry.

Levelling :- Levelling instruments; types of leveling; characteristics and uses of contours; methods of contouring; booking and reduction methods; shaft depth measurement; temporary and permanent adjustment of levels; problems solving.

Controlled surveys :- Triangulation; trilateration; application of GPS and Total Station in mine surveying.

Correlation :- Methods of correlation surface and underground including Gyro-Laser combination.

Development and stone surveys :- Surveys of flat, moderately and steeply inclined and vertical workings; control of direction and gradient in drifts, tunnels, raises and winzes; traversing along steep working with or without auxiliary telescopes.

Theory of errors and adjustments: Causes and classification of errors; indices of precision; laws of weight; propagation and adjustment of errors; adjustment of triangulation figures.

National grid : Map projection Cassini Lambert's polyconic and universal transfers Mercator; transformatic of coordinates.

Astronomy :- Astronomical triangle; conversion of time systems and precise determination of azimuth by astronomical methods.

Area and volume calculation :- Different methods and their limitations; earth work and building estimation; laying out of rail and haul road curves, surface and underground.

Dip, strike, fault and outcrop problems, borehole surveying and calculations.

Types of plans and their preparation, care, storage and preservation; legislation concerning mine plans and sections; duties and responsibilities of surveyors.

Application of computers in mine surveying and preparation of plans.

(e) Mine Management : Legislation : Environmental Management and General Safety.

Mine Management :-

Introduction :- Principles of scientific management; management function; planning; organization and control; structure and design of organization for mining enterprises.

Personal Management :- Selection; training and development of human resources.

Production Management :- Production planning; scheduling and control; short term and long term planning; productivity; concepts and measurements.

Environmental Management:- Mine environment monitoring and control; EMP (Environment Management Plan), mine closure plan; R&R (rehabilitation and re-settlement).

Mine Legislation :-

Health and Safety Laws :- The Mines Act, 1952; Mines Rules 1955, Metalliferous Mine Regulation, 1961, Mines Rescue Rules, 1985, provisions of Indian Electricity Rules, 1956 applicable to mines; Vocational Training Rules, 1966, other rules and legislation as applicable to opencast metalliferous mines.

General Safety in Mines

Safety in Mines :- Causes and prevention of accidents and their classification; frequency rate and severity rates; cause-wise analysis, investigation into accidents and accident report; in-depth study into various causes of accidents measures for improving safety in mines; risk assessment and risk management; cost of accident; safety management system; human elements in mine safety, workers participation in safety management; ISO and safety audit; safety conferences; tripartite and bipartite committees.

Disaster management :- rescue and recovery; mine rescue; mine gases and their physiological effects; rescue equipments; resuscitation and reviving apparatus; selection and training for rescue work.

First aid and ambulance work.

Silicosis and pneumoconiosis, physiological aspects of breathing in dust laden atmosphere; dust sampling and sampling instruments; methods of counting and analysis; other mines diseases and their symptoms; preventions and treatment.

Lighting :- General principles of artificial lighting; lighting standards and their assessment.

Sanitation and health in mines.

Safety related issues in mineral beneficiation and transport.

[No.Board/Metal/941/2009]

M.M. SHARMA, Director General of Mines Safety &
Chairman, Board of Mining Examination (Metal)

New Delhi, the 04th May, 2009

APPENDIX – I
SYLLABUS FOR EXAMINATION FOR MINE SURVEYORS CERTIFICATES OF COMPETENCY
(Under Metalliferous Mines Regulations, 1961)
FIRST PAPER

Linear measurement :- Instruments for measuring distance and ranging, chain surveying; errors in chaining and plotting; optical square.

EDM :- Principles of measurements; types; correction and selection of instrument.

Angular measurement :- Prismatic compass; bearing of lines; local attraction; magnetic declination.

Plan Table Surveying; methods contouring using plane table and micro-optic alidade.

Miners' dials and other compass instruments; dialing; loose and fast needle surveying.

Theodolite :- Modern micro-optic theodolites; measurement of horizontal and vertical angles; theodolite traversing; traverse calculation; computation of coordinates; adjustment of traverse; temporary and permanent adjustment.

Levelling :- Levelling instrument types of leveling; booking and reduction methods; temporary and permanent adjustment of levels; geometrical, trigonometric and physical leveling; characteristics and uses of contours; methods of contouring; traverse; co-ordinates and leveling problems.

Tachometry:- Controlled surveys :- Triangulation; trilateration; application of GPS and Total Station in mine surveying.

Use, care, testing, and adjustments of instruments.

SECOND PAPER

Field astronomy :- Astronomical terms; determination of true bearing by equal altitude method; Gyro theodolite; principle and determination of Gyro north.

National grid : Map projection Cassini Lambert's polyconic and universal transfers Mercator; transformation of coordinates, vertical projections; mine models.

Geodesy :- Geod, spheroid and ellipsoid, geocentric, geodetic and astronomical coordinates, orthometric and dynamic heights.

Astronomy :- Astronomical triangle; conversion of time systems and precise determination of azimuth by astronomical methods.

Photogrammetry :- Introduction; scale of a vertical photograph; photographs versus maps; application of photogrammetry in mining.

Correlation :- Method of correlation surface and underground including Gyro-Laser combination.

Theory of errors and adjustments: Causes and classification of errors; inclines of precision; laws of weight propagation and adjustment of errors; adjustment of triangulation figures.

Control of direction and gradient in inclined shafts, shifts, tunnels, raises and winzes; surveying of flat, moderately and steeply inclined, and vertical ore bodies.

Area and volume calculation; different methods and their limitations; earth work and building estimation; laying out of rail curves on surface and underground; measurement of depths of incline roadways and shafts; determination of azimuth latitude and longitude.

Borehole surveying and calculations; dip, strike, outcrop and fault problems.

Development sampling :- Channel and block averaging; stope sampling; averaging of stope-face boundaries; valuation of block roof tonnages; milling widths; observe plans.

Types of plans their preparation, care, storage and preservation; legislation concerning mine plans and sections; duties and responsibilities of surveyors.

Geological map reading.

Application of computers in mine surveying and preparation of plans. 3D laser profiling of bench walls in opencast mine.

[No.Board/Metal/942/2009]

M.M. SHARMA, Director General of Mines Safety &
Chairman, Board of Mining Examination (Metal)

New Delhi, the 04th May, 2009

G.S.R. 65. – In pursuance of the provisions of Regulation 13(4) of the Metalliferous Mines Regulations, 1961, the bye-laws for the conduct of examination and grant of Foremans Certificates of Competency so far as they relate to Syllabus for Examination, (Appendix – I) is being substituted by the following :-

APPENDIX – I

SYLLABUS FOR EXAMINATION FOR MINE FORMAN'S (UNRESTRICTED) CERTIFICATES OF COMPETENCY (Under Metalliferous Mines Regulations, 1961)

(a) General Safety and Legislation

Duties and responsibilities of workmen, competent persons and officials (excluding managers, assistant managers); discipline amongst workers and control of staff.

Provisions of the Metalliferous Mines Regulations, 1961, relating to mine working; explosives and blasting; haulage; ventilation; precautions against danger from fire, dust, gas and water and of other provisions and Rules, the enforcement of and compliance with which is the responsibility of mine foremen.

Writing of reports required to be made by mine foreman under the regulations.

Dangerous occurrences in mines and dealing with the same; accidents, their causes and preventions; accident reports; not disturbing the place of accident.

Mine rescue; physiological effect of mine gases; rescue equipment and First Aid.

Sanitation and health; miners' diseases, their symptoms and preventions.

(b) Methods of Working.

Nature of occurrence of mineral deposits; geological disturbances and their effects on working conditions; dangers and precautionary measures while approaching geological disturbances areas.

The purposes and utility of boreholes in mines; shaft sinking; safety devices; temporary and permanent supports in sinking and working shafts; estimation of shafts and outlets.

Opencast methods of mining; mechanized and manual methods; deep hole drilling and blasting; shovel and dumpers; dragline; bucket wheel excavators; surface continuous miner; benching; maintenance of haul roads; other safety precautions; methods of reclamation; dump management.

General principles of primary and secondary development; stopping methods; manual and mechanized stone drifting.

Elements of roof control; mechanism of rock bolting; support of roadways; face supports and their types, setting, testing and withdrawal; systematic timbering

rules; packing and stowing; protection of surface structures; working beneath statutorily restricted areas and surface structures.

Safe handling and use of explosives; deep hole drilling and blasting; safety precautions.

Inspection of workings; inspection and maintenance of haulage and travelling roadways; man riding system and return airways; gates and fences.

Reading of statutory plans.

(c) Ventilation and Precautions against Explosives: Fires and Inundation

Natural and mechanical ventilation ; ventilation of headings and sinking shafts; siting of auxiliary and booster fans; distribution, measurement and control of air in mines; estimation of air quantity requirements; methods of coursing of air; anemometer; hygrometer; maintenance of ventilation appliances.

Pollution of air; irruption/occurrence of gases in mines; properties of gases; detection and measurement of firedamp and noxious gases; sampling of air; determination of environmental condition; standards of ventilation.

Design and construction of flame and electric safety lamps; their use, examination and maintenance.

Suppression and treatment, sampling and analysis of mine dust.

Elementary knowledge of causes and prevention of firedamp and sulphide dust explosion, limits of inflammability of fire-damp.

Fires and spontaneous heating; prevention, detection and control of mine fire; sealing off fire areas; fire stopping and their examination; precautions against outbreak of surface fires; fire fighting on surface and belowground.

Inspection of old workings.

Sources of danger from surface and belowground water, precaution, to prevent inundation and irruption of water; precautionary measures while approaching abandoned and water logged areas, boring machines for exploratory work; water dams; water danger plan.

Recovery of mines after explosions fires and inundation; precautionary measures during re-opening and dewatering of mines.

(d) Elements of Mining Machinery.

Safety aspects and safe use of different kinds of machinery used in underground and opencast mines including blast hole drills, rippers; scrappers; shovels; draglines; dumpers; road graders; dozers; wheel loaders; bucket wheel excavators; spreaders; surface continuous miners; brakes (including service and parking brakes); generation and use of compressed air; use of steam and internal combustion engines in mines.

Application of electricity in mines; safety precautions.

Winding equipments; ropes and guides; signaling and decking arrangements; safety devices; examination of winding equipments and shaft fittings.

Haulage and transport; types of haulage; rope haulage and locomotives; self-acting inclines; haulages; roads in underground and opencast working; rails and tracks; their maintenance and inspection; tubs; signaling; safety devices; codes of practices; traffic rules; unsafe practices; derailments.

Different types of pumps; principles and use of siphons; drainage and water lodgments.

Code of practice for transport, installation, use and shifting of underground and opencast machinery.

Belt conveyors and safety appliances.

[No.Board/Metal/943/2009]
M.M. SHARMA, Director General of Mines Safety &
Chairman, Board of Mining Examination (Metal)

New Delhi, the 04th May, 2009

G.S.R. 66. – In pursuance of the provisions of Regulation 13(4) of the Coal Mines Regulations, 1957, the bye-laws for the conduct of examination and grant of Manager's Certificates of Competency so far as they relate to Subject and Syllabus for Examination, for First Class Manager's Certificate (Appendix – I) and for Second Class Manager's Certificate (Appendix – II) is being substituted by the following :-

Certificate of competency	Bye law No.	Existing Provisions	Substituted Provisions
Managers Certificate of Competency	5	Subjects and syllabus for Examination (a) Winning and Working. (b) Mine Management, Legislation and General Safety. (c) Mine Ventilation, Explosions, Fires and Inundation. (d) Mine Surveying. (e) Mining Machinery	Subjects and syllabus for Examination (a) Mine Management, Legislation and General Safety (b) Winning and Working. (c) Mine Ventilation, Explosions, Fires and Inundation. (d) Mining Machinery and Electricity (e) Mine Surveying.

APPENDIX-I

SYLLABUS FOR THE EXAMINATION FOR FIRST CLASS MANAGER'S CERTIFICATE OF COMPETENCY

(Under Coal Mines Regulations, 1957)

(a) Mine Management : Legislation and General Safety.

Mine Management :-

Introduction :- Evolution of management; theory and practice; principles of scientific management; elements of management function; planning; organization and control; structure and design of organization for mining enterprises.

Personal Management and Organizational behavior Selection; training and development of human resources for mining enterprises; leadership; study of traditional leader behaviour; autocratic; democratic and Laissez-Faire behaviors; conflict management; conflict in organization; sources of conflict; dealing with conflict; organizing for conflict resolution; conflict and growth individual motivation; two way personal communication.

Production Management :- Determination of norms and standards of operations by work study, analysis of mine capacities and capability; production

planning, scheduling and control; short term and long term planning; productivity; concepts and measurements; application of Ergonomics in mine operation.

Financial Management :- Capital budgeting; techniques for mining project; project evaluation; payback period and IRR; methods of cost analysis and cost control; breakeven charts; working capital management; ERP (Enterprise Resources Planning).

Mining Environment:- EIA (Environment Impact Assessment), EMP (Environment Management Plan), ETP (Effluent Treatment Plant), STP (Sewerage Treatment Plant), threat to environment from underground and surface mining, means of mitigation, treatment of pollutants, monitoring systems, water management; mine closure plan; R&R (rehabilitation and re-settlement).

Economic Impact of Mining Economics of mining effect on community – before, during and after mining corporate social responsibility (CSR).

Materials Management for mining sector; ABC analysis, Inventory Management.

Industrial Accident :- Study of human factors of industrial accidents; their causes and remedies.

Mine Legislation :-

Health and Safety Laws :- The Mines Act, 1952; Mines Rules 1955, Coal Mine Regulation, 1957, Mines Rescue Rules, 1985, provisions of Indian Electricity Rules, 1956 applicable to mines; Mine Vocational Training Rules, 1966, other rules and legislation as applicable to opencast metalliferous mines.

General Safety in Mines

Safety in Mines :- Duty of care; occupational hazards of mining; causes and prevention; accidents and their classification; accident statistics; frequency rate an severity rates; cause-wise analysis, basic causes of accident occurrence; investigation into accidents and accident report; in-depth study into various causes of accidents measures for improving safety in mines; TRAP (take responsibility in accident prevention); cost of accident; safety management system; contribution of human elements in mine safety, workers participation in safety management; ISO and safety audit; safety conferences; tripartite and bipartite committees; role of information technology in safety management.

Risk Management :- Theory and application, baseline, continuous and issue based risk assessment, risk management techniques and application, means of managing (minimizing or eliminating) risk, computer application and simulations, manager's role in risk management, due diligence, application of risk assessment and risk management with reference to due diligence.

Disaster management :- Emergency services, equipments and procedures, emergency control rooms, rescue and recovery; procedure and responsibilities, safety of persons engaged in emergency response, investigations and reports; assessment of damage, mine rescue; mine gases and their physiological effects; rescue equipments; resuscitation and reviving apparatus; selection and training for rescue work.

First aid and ambulance work.

Notified and occupational diseases; silicosis and pneumoconiosis, physiological aspects of breathing in dust laden atmosphere; dust sampling and sampling instruments; methods of counting and analysis; other mines diseases and their symptoms; preventions and treatment.

Lighting :- General principles of artificial lighting; lighting standards and their assessment.

Sanitation and health in mines.

Safety related issues in mineral beneficiation and transport.

(b Winning and Working

Geology :- Nature and occurrence of coal seams; description of Indian coalfields; application of geology to mining; geological structures; folds, faults, fractures, fissures etc. boring through disturbed strata; bore hole survey; indicated and proved coal reserves; interpretation of geological maps.

Opening of coal seams: Legal requirement about outlets; siting; vertical shaft; inclines shaft; inclines; shafts sinking and deepening; drift drivage; mechanized sinking; in ordinary and water logged grounds, in running sand etc.; freezing, cementation and other special methods; shaft supports, temporary and permanent, tubings etc., recent developments.

Developments and layout of mines including surface and underground arrangements; layout and development of shaft-top and pit-bottom and haulage arrangements.

Underground Mining Methods; Choice of methods of mining coal seams and factors affecting the same; statutory provisions.

Board and Pillar method :- Schemes of development; design of bord and pillar working; statutory provisions selection of equipment for development mechanized loaders, continuous miners etc., preparatory arrangement for depillaring; statutory provision for depillaring; designing the system of pillar extraction with caving and stowing; mechanization in depillaring operation; types of loading machines; continuous miners etc.; roof management; local fall and main fall; indications of roof weighting; air blasts and precautions against the same; precautions against fire and inundation during depillaring; multi-section and contiguous working; liquidation of developed pillars.

Longwall mining :- Method of driving gate roads; single and multiple heading gate roads; longwall face layout advancing and retreating faces; orientation of longwall face; support system for longwall gate roads; powered support; face transfer, operation of shearer and plough; roof management and hard roof management; periodic and main fall; design of high productive longwall panel; mini/short wall mining; communication and telemonitoring.

Thick seam mining :- Board and pillar and longwall methods in multi-section; multi-slice methods; inclined slicing; horizontal slicing and cross slicing in ascending and descending orders; under winning methods; sublevel caving; integral caving; blasting gallery and descending shield methods; hydraulic mining; special methods of thick seam mining.

Other special methods of mining :- Wide stall method; methods of mining thin seams; underground coal gasification, coal bed methane/ coal mine methane etc.

Opencast Mining: Opening of deposits and preparation for excavation; box cut, types; selection of site; formation of production benches; ripping; types of rippers; concept of rippability and cycle of operation; drilling; blast hole drills; performance parameters; requirement of number of drills; blasting; blast design; factors influencing blast design; deep hold blasting; calculation of charge per hole; ground vibration; secondary blasting and problems of blasting side casting; environment friendly non-blasting techniques; safety aspects.

Discontinuous/cyclic methods of excavation and transport; shovel dumper operation; applicability of electric shovel and hydraulic excavators; cycle time and productivity calculation; estimation of equipment fleet; dragline operation; side casting; side cast diagram; calculation of reach; cycle time; productivity calculation;

bucket capacity requirement; scrappers; types; methods of work; push pull operation etc., bucket wheel excavator; operational methods (lateral block, half block and full block etc.,) productivity calculation; continuous surface miner; operational methods (wide/full base methods, wide/full bench, block mining, stepped cut, empty travel back, turn back and continuous mining methods); conveyors; shiftable and high angle conveyors; mode of operation etc;, OITDS (operator independent truck dispatch system); in-pit crushing and strip-mining; opencast mining over developed coal seams; high-wall mining; safety aspect.

Application of concepts of Rock Mechanics for designing the methods of mining and strata control; Theories of ground movement and strata control; stress, strain compressive and tensile, shear strength uniaxial and tri-axial strength, Poisson's Ratio, Young's Modulus, convergence, elasticity, lithostatic and hydrostatic pressure; rock mass classification, strength of stooks; shaft pillar; protection of surface structures; design and stability of structures in rock; design of support and reinforcement for underground excavations support resistance, yielding and non-yielding supports, dynamic and static loading, measuring instruments, consolidated and unconsolidated fills, rock bolts, cable bolts, latest developments in mine supports, economics of support design, subsidence; caving of rock mass; bumps; monitoring of rock mass performance; mechanics of rock fragmentation; slope stability and dump stability; dump management; roof management.

Development of safe explosives; permitted explosives; composition and testing of safe explosives Milli-second detonators; alternatives of explosives. Use and safe handling of explosives in coal and stone drivages in gassy and non-gassy mines, blasting techniques and their relative efficiency, total cost concept.

Application of numerical modeling in mine design application of computers in mine design and operational controls.

(c) Mine Ventilation, Explosives, Fires and Inundation

Composition of mine atmosphere; Mine gases; generation, properties and effects; sampling and analysis of mine air; methane content; methane drainage; flame safety lamp; methanometers and multi-gas detectors; gas chromatograph; methane layering; monitoring of different gases; telemonitoring; coal bed methane/coal mine methane.

Heat and humidity :- Sources of heat in mines; geothermal gradient; heat flow in deep mines; effects of heat and humidity; psychometrics; computation of thermodynamic properties of mine air; basic modes of heat transfer in mines; methods of calculation of heat flow and temperature rise in mine airways; heat and moisture transfer in bord and pillar and longwall workings; Computation of heat load due to various machines e.g. belt conveyor, power pack stage loader, lump breaker, armoured flexible conveyor, shearer etc. in longwall gate roads and face and road header, continuous miner and underground sub-stations etc. in the mine; air cooling and conditioning.

Air flow in mines:- Laws of air flow; resistance of airways; resistance and splitting problems; equivalent orifice; flow control devices; permissible air velocities.

Natural ventilation :- Seasonal variations; calculation of natural ventilation pressure; thermodynamic principles and other short-cut methods.

Mechanical ventilation :- Theory of different fans; characteristics and suitability of fan; selection, testing and output control; fans in series and parallel; reversal of air flow; fan drift, diffuser and evasee; booster and auxiliary fans;

ventilation of heading and sinking shafts; standards of ventilation; ventilation calculation.

Ventilation planning :- Ventilation layout; determination of size of shafts and airways; estimation of air quantity requirements; ventilation network analysis; Hardy Cross methods of iterative analysis and application of linear theory; thermodynamic network analysis and computer application; application of numerical modeling; estimation of pressure requirement; ventilation survey; recent development in mine ventilation, ventilation plans.

Airbone dust :- Generation, dispersion, measurement and control; suppression and treatment of mine dust; properties of stone dust; sampling and analysis of mine dust.

Mine fires:- Cause of mine fires, spontaneous combustion, mechanism and susceptibility indices detection and prevention of spontaneous heating and mine fires; dealing with mine fires; sealing off fire-areas; build-up of extinctive atmosphere; pressure balancing; fire fighting organization; gas ratios and their limitations; modified gas ratios; reopening of sealed off fire areas; fires in quarries over developed pillars; coal stack and waste dump fires.

Mine explosions :- Fire damp and coal dust explosions; cause and prevention; stone dust barrier; water barrier and other methods.

Explosion in quarries over developed pillars. Water gas explosion.

Inundation :- Causes and prevention; precautions and techniques of approaching old water logged working; safety boring apparatus; pattern of hole; design and construction of water dams; water lodgements; monsoon preparations, water danger plan.

Recovery of mine after explosion, fires and inundation rescue and recovery in mines; rescue apparatus; organization of rescue work; emergency preparedness and response system.

Illumination :- Cap lamps, layout and organization of lamp rooms; standards of illumination; photometry and illumination survey.

Risk Assessment and analysis with reference to mine environment, management of environmental risks.

(d) Mining Machinery and Electricity

Theory of Machines :- Machine design, different types of gears and drives, bearing, collars and joints, brakes and friction clutches, governors.

Heat engines, general outline of working principles of steam generators and auxiliary equipment, condensing plant, reciprocating steam engines, turbines, internal combustion engines, conduct of gas, oil and steam engine trial; mechanical efficiency of engines, measurement of indicated and brake horsepower.

Machine tools and workshop processes:-

Wire ropes :- Construction details, applications, mechanical properties, breaking load, factor of safety bending factor, capacity factor, snap length, critical depth inspection; examination and discarding criteria; rope capping and splicing.

Mine winders :- Types and applications components; shaft fitting; drums and sheaves; ropes and guides; drives and control systems; automatic contrivances; brakes; cage; skip; counter weight and suspension arrangement; duty cycle diagram; winder capacity and motor power calculations; equivalent mass of winder installation; safety devices; Installation; examination and testing of winding equipment, non destructive testing.

Underground machinery :- Coal drills; jumbo drills; roof bolters; quad bolters; UDM; shearers; ploughs; AFC; road headers; ding headers; continuous miners; shuttle cars; SDLs; LHDs.

Material handling equipment in mines; Types, construction and operation; safety devices; maintenance and calculations for rope haulages; locomotives (tractive effort, draw bar pull, ideal gradient), conveyors, systems (belt conveyor, chain conveyor, cable belt conveyor, high angle conveyor, shiftable belt conveyor, pipe conveyor); aerial rope-ways, man riding systems; in-pit crushers, feeder breaker etc., mine cars, track design and layout; super elevation; track fitting and safety appliances; self acting inclines; coal handling plants; rail wagon loading; plants; use of diesel equipments in underground coal mines, free steered vehicles.

Pumps :- Types, Characteristics, motor power, capacity and calculations, laying of water mains, dealing with acid water; slurry, drainage; lodgements, storage, designs and layout of dams, sumps, pumping problems.

Opencast machinery :- Constructions, function and operation of blast hole drills, rippers, scrapers, shovels; draglines, dumpers, road graders, dozers, wheel loaders; bucket wheel excavators; spreaders; surface continuous miners and their maintenance aspects.

Generation, transmission and utilization of power, steam, compressed air; air compressor and auxiliary equipment; air turbines and air engines; efficiency of power, electricity and steam systems; safety aspects.

Maintenance Systems :- Monitoring and reporting tribology – corrosion, planned maintenance, Preventive, periodical and total maintenance systems in mines. Condition based monitoring and related maintenance system.

Mine electrical engineering :- Generation, Transmission and distribution of electrical power in mines; radial and ring main distribution; power economics; industrial tariffs; power factor improvement; sub-station arrangements; short transmission lines; cables; switch gears and protective devices; protective relays; circuit breakers; gate-end box; drill panel; field switch; transwitch; symmetrical fault and circuit breaker rating; mine signaling; electrical drives and semiconductor controllers; selection of motors and starters; semiconductor devices; principles of operation of thyristor controlled variable speed electrical drives; electrical breaking; earthing; flameproof enclosures and intrinsic safety; use of high voltage operational equipment in mines.

(e) Mine Surveying

Linear measurement :- Instruments for measuring distance and ranging, units of measurement in surveying.

EDM :- Principles of measurements; types; correction and selection of instrument.

Angular measurement :- Prismatic compass; bearing of lines; local attraction; magnetic declination.

Dials; loose and fast needle surveying; plan table surveying and micro-optic alidade.

Theodolite :- Modern micro-optic theodolites; measurement of horizontal and vertical angles; theodolite traversing; traverse calculation; computation of coordinates; adjustment of traverse; temporary and permanent adjustment; tacheometry.

Levelling :- Levelling instruments; types of leveling; characteristics and uses of contours; methods of contouring; booking and reduction methods; shaft depth measurement; temporary and permanent adjustment of levels; problems solving.

Controlled surveys :- Triangulation; trilateration; application of GPS and Total Station in mine surveying.

Field astronomy :- Astronomical terms; determination of true bearing by equal altitude method; Gyro theodolite; principle and determination of Gyro north. Astronomical triangle; conversion of time system and precise determination of azimuth by astronomical methods.

Correlation :- Methods of correlation surface and underground including Gyro-Laser combination.

Development and stone surveys :- Surveys of flat, moderately and steeply inclined and vertical workings; control of direction and gradient in drifts and roadways traversing along steep working with or without auxiliary telescopes; 3D laser profiling of bench walls in opencast working.

Theory of errors and adjustments: Causes and classification of errors; inclines of precision; laws of weight; propagation and adjustment of errors; adjustment of triangulation figures.

National grid : Map projection Cassini Lambert's polyconic and universal transfers Mercator; transformation of coordinates.

Geodesy :- Geod, spheroid and ellipsoid, geocentric, geodetic and astronomical coordinates, orthometric and dynamic heights.

Photogrammetry :- Introduction; scale of a vertical photograph; photographs versus maps; application of photogrammetry and remote sensing in mining.

Area and volume calculation :- Different methods and their limitations; earth work and building estimation; laying out of rail curves and haul road curves, surface and underground.

Dip, and strike problems; outcrop problems; borehole surveying and calculations.

Types of plans and their preparation, care, storage and preservation; legislation concerning mine plans and sections; duties and responsibilities of surveyors.

Application of computers in mine surveying and preparation of plans.

APPENDIX – II

SYLLABUS FOR THE EXAMINATION FOR SECOND CLASS MANAGER'S CERTIFICATE OF COMPETENCY

(Under Coal Mines Regulation, 19570

(a) Mine Management : Legislation : and General Safety.

Mine Management :-

Introduction :- Principle of scientific management; management functions; planning; organization and control; structure and design of organization for mining enterprises.

Personal Management:- Selection; training and development of human resources for mining enterprises;

Production Management :- Production planning, scheduling and control; short term and long term planning; productivity; and its measurements.

Environmental Management :- Mine Environment monitoring and control; EMP (Environment Management Plan); mine closure plan; R&R (rehabilitation and resettlement).

Mine Legislation :-

Health and Safety Laws :- The Mines Act, 1952; Mines Rules 1955, Coal Mine Regulation, 1957, Mines Rescue Rules, 1985, provisions of Indian Electricity Rules, 1956 applicable to mines; Vocational Training Rules, 1966, other rules and legislation applicable to coal mines.

General Safety in Mines

Safety in Mines :- Causes and prevention of accidents and their classification; accident statistics; frequency rate an severity rates; cause-wise analysis, investigation into accidents and accident report; in-depth study into various causes of accidents measures for improving safety in mines; risk assessment and risk management; cost of accident; safety management system; human elements in mine safety, workers participation in safety management; ISO and safety audit; safety conferences; tripartite and bipartite committees.

Disaster management :- rescue and recovery; mine rescue; mine gases and their physiological effects; rescue equipments; resuscitation and reviving apparatus; selection and training for rescue work.

First aid and ambulance work.

Notified and occupational diseases; silicosis and pneumoconiosis, physiological aspects of breathing in dust laden atmosphere; dust sampling and sampling instruments; methods of counting and analysis; other mines diseases and their symptoms; preventions and treatment.

Lighting :- General principles of artificial lighting; lighting standards and their assessment.

Sanitation and health in mines.

Safety related issues in mineral beneficiation and transport.

(b) Winning and Working

Geology :- Nature and occurrence of coal seams; description of Indian coalfields; geological features of coalfields; methods of boring; boring through disturbed strata; bore hole survey; interpretation of geological maps.

Opening of coal seams: shafts sinking and drift drivage; methods of sinking; mechanized sinking; in ordinary and water logged grounds, and other special methods; shaft supports, temporary and permanent; mechanized stone drifting etc.

Developments and layout of mines including surface and underground arrangements; layout and development of shaft-top and pit-bottom and haulage arrangements.

Underground Mining Methods; Choice of methods of mining coal seams and factors (depth, seam thickness, inclination etc.) affecting the same; statutory provisions.

Board and Pillar method :- design of bord and pillar working; statutory provisions mechanized loaders, continuous miners etc., depillaring and applicable statutory provision pillar extraction with caving and stowing; mechanization in depillaring; local fall and main fall; indications of roof weighting; air blasts and precautions against the same; precautions against fire and inundation; multi-section and contiguous working.

Longwall mining :- Method of driving single and multiple heading gate roads; orientation of longwall face; advancing and retreating faces; support system for longwall gate roads; powered support; face transfer, operation of shearer and plough; periodic and main fall; mini/short wall mining; communication and telemonitoring.

Thick seam mining :- Board and pillar and longwall methods in multi-section; multi-slice methods; inclined slicing; horizontal slicing and cross slicing in ascending and descending orders; under winning methods; sublevel caving; integral caving; blasting gallery and descending shield methods; hydraulic mining; special methods of thick seam mining.

Other special methods of mining :- Wide stall method; methods of mining thin seams; underground coal gasification, coal bed methane/ coal mine methane etc.

Opencast Mining: Opening of deposits and preparation for excavation; box cut, types; site selection; formation of benches; rippability; types of rippers; cycle of operation; drilling; blast hole drills; performance parameters; requirement of number of drills; blasting; blast design; factors influencing blast design; deep hold blasting; calculation of charge per hole; ground vibration; secondary blasting and related problems; surface miners; safety aspects.

Discontinuous/cyclic methods of excavation and transport; shovel dumper operation; electric shovel and hydraulic excavators; cycle time and productivity calculation; estimation of equipment fleet; dragline operation; side casting; calculation of reach; cycle time; productivity calculation; bucket capacity requirement; scrappers; bucket wheel excavator; (lateral block, half block and full block etc.,) productivity calculation; continuous surface miner; (wide/full base, wide/full bench, block mining, stepped cut, empty travel back, turn back and continuous mining methods); conveyors; shiftable and high angle conveyors; in-pit crushing and strip-mining; opencast mining over developed coal seams; high-wall mining; safety aspect.

Application of concepts of Rock Mechanics for designing the methods of mining and strata control; Theories of ground movement and strata control; strength of stooks; shaft pillar; protection of surface structures; design and stability of structures in rock; rock mass rating; design of support and reinforcement for underground excavation consolidated and unconsolidated fills, rock bolts, cable bolts, subsidence, caving of rock mass; bumps monitoring of rock mass performance; mechanics of rock fragmentation; slope stability and dump stability; dump management; roof management.

Use and safe handling of explosives; blasting techniques and their relative efficiency, total cost concept.

(c) Mine Ventilation, Explosives, Fires and Inundation

Composition of mine atmosphere; Mine gases; generation, properties and effects; sampling and analysis of mine air; occurrence, properties, characteristics, detection and measurement of firedamp; methane drainage; flame safety lamp; methanometers and multi-gas detectors; gas chromatograph; methane layering; monitoring of different gases; telemonitoring; coal bed methane/coal mine methane.

Flame safety lamps and their design; use of maintenance; testing of safety lamps; lamp house and organization.

Heat and humidity :- Sources of heat in mines; geothermal gradient; effects of heat and humidity; heat transfer in bord and pillar and longwall workings; methods of calculation of heat flow and temperature rise; heat load due to various machines; air cooling and conditioning.

Air flow in mines:- Laws of air flow; resistance of airways; resistance and splitting problems; equivalent orifice; flow control devices; permissible air velocities.

Natural ventilation :- Seasonal variations; calculation of natural ventilation pressure.

Mechanical ventilation :- Mechanical ventilators; characteristics and selection, testing and output control; fans in series and parallel; reversal of air flow; fan drift, diffuser and evasee; booster and auxiliary fans; standards of ventilation; ventilation calculation.

Ventilation planning :- Ventilation layout; determination of size of shafts and airways; estimation of air quantity requirements; ventilation network analysis; thermodynamic network analysis and computer application; estimation of pressure requirement; ventilation survey; recent development in mine ventilation, ventilation plans.

Airbone dust :- Generation, dispersion, measurement and control; suppression and treatment of coal dust; properties of stone dust; sampling and analysis of coal dust.

Mine fires:- Cause of mine fires, spontaneous combustion, mechanism and susceptibility indices (crossing and ignition point temperature); wet oxidation potential; factors affecting spontaneous combustion; detection and prevention; dealing with mine fires; sealing off fire-areas; build-up of extinctive atmosphere; pressure balancing; fire fighting organization; gas ratios and their limitations; modified gas ratios; reopening of sealed off fire areas; fires in quarries over developed pillars; coal stack and waste dump fires.

Mine explosions :- Inflammability of fire damp and coal dust; fire damp and coal dust explosions; cause and prevention; stone dust barrier; water barrier and other methods.

Explosion in quarries over developed pillars.

Water gas explosion.

Inundation :- Causes and prevention; precautions and techniques of approaching old water logged working; safety boring apparatus; pattern of hole; design and construction of water dams; water lodgements; monsoon preparations, water danger plan.

Recovery of mine after explosion, fires and inundation and investigation rescue and recovery in mines; rescue apparatus; organization of rescue work; emergency preparedness and response system; emergency organization.

Illumination :- Cap lamps, layout and organization of lamp rooms; standards of illumination; photometry and illumination survey.

(d) Mining Machinery and Electricity

Theory of Machines :- Machine design, different types of gears and drives, bearing, collars and joints, brakes and friction clutches, governors.

Heat engines, general outline of working principles of steam generators and auxiliary equipment, condensing plant, reciprocating steam engines, turbines, internal combustion engines, conduct of gas, oil and steam engine trial; mechanical efficiency of engines, measurement of indicated and brake horsepower.

Machine tools and workshop processes:-

Wire ropes :- Construction details, applications, mechanical properties, breaking load, factor of safety bending factor, capacity factor, snap length, critical depth inspection; examination and discarding criteria; rope capping and splicing.

Mine winders :- Types and applications components; shaft fitting; drums and sheaves; ropes and guides; drives and control systems; automatic contrivances; brakes; cage; skip; counter weight and suspension arrangement; duty cycle diagram; winder capacity and motor power calculations; equivalent mass of winder installation; safety devices; Installation; examination and testing of winding equipment, non destructive testing.

Underground machinery :- Coal drills; jumbo drills; roof bolters; quad bolters; UDM; shearers; ploughs; AFC; road headers; ding headers; continuous miners; shuttle cars; SDLs; LHDs.

Material handling equipment in mines; Types, construction and operation; safety devices; maintenance and calculations for rope haulages; locomotives (tractive effort, draw bar pull, ideal gradient), conveyors (belt, chain, cable belt, high angle, shiftable and pipe conveyor); aerial rope-ways, man riding systems; in-pit crushers, feeder breaker etc., mine cars, track super elevation; track fitting and safety appliances; self acting inclines; coal handling plants; rail wagon loading; plants; use of diesel equipments in underground coal mines, free steered vehicles.

Pumps :- Types, Characteristics, motor power, capacity and calculations, laying of water mains, dealing with acid water; slurry, drainage; lodgements, storage, designs and layout of dams, sumps, pumping problems.

Opencast machinery :- Constructions, function and operation of blast hole drills, rippers, scrapers, shovels; draglines, dumpers, road graders, dozers, wheel loaders; bucket wheel excavators; spreaders; surface miners and their maintenance aspects.

Generation, transmission and utilization of power, steam, compressed air; safety aspects.

Preventive, periodical and total maintenance systems in mines.

Mine electrical engineering :- Generation, Transmission and distribution of electrical power in mines; radial and ring main distribution; substation arrangements; short transmission lines; cables; switch gears and protective devices; protective relays; circuit breakers; gate-end box; drill panel; field switch; transwitch; symmetrical fault and circuit breaker rating; mine signaling; power factor improvement; electrical drives and semiconductor controllers; selection of motors and starters; semiconductor devices; principles of operation of thyristor controlled variable speed electrical drives; electrical breaking; earthing; flameproof enclosures and intrinsic safety; use of high voltage operational equipment in mines.

(e) Mine Surveying

Linear measurement :- Instruments for measuring distance and ranging, units of measurement in surveying.

EDM :- Principles of measurements; types; correction and selection of instrument.

Angular measurement :- Prismatic compass; bearing of lines; local attraction; magnetic declination.

Theodolite :- Modern micro-optic theodolites; measurement of horizontal and vertical angles; theodolite traversing; traverse calculation; computation of coordinates; adjustment of traverse; temporary and permanent adjustment; Gyro thedolite; principle and determination of Gyro north; determination of true bearing by equal altitude method; tacheometry.

Levelling :- Levelling instruments; types of leveling; characteristics and uses of contours; methods of contouring; booking and reduction methods; shaft depth measurement; temporary and permanent adjustment of levels.

Controlled surveys :- Triangulation; trilateration; application of GPS and Total Station in mine surveying.

Field astronomy :- Astronomical terms; determination of true bearing by equal altitude method; Gyro theodolite; principle and determination of Gyro north. Astronomical triangle; conversion of time system and precise determination of azimuth by astronomical methods.

Correlation :- Methods of correlation surface and underground including Gyro-Laser combination.

Development surveys :- Surveys of flat, moderately and steeply inclined and vertical workings; control of direction and gradient in drifts and roadways traversing along steep working with or without auxiliary telescopes.

Theory of errors and adjustments: Causes and classification of errors; inclines of precision; laws of weight; propagation and adjustment of errors; adjustment of triangulation figures.

National grid : Map projection Cassini Lambert's polyconic and universal transfers Mercator; transformation of coordinates.

Area and volume calculation :- Different methods and their limitations; earth work and building estimation; laying out of rail curves, surface and underground.

Dip, and strike problems; outcrop problems; borehole surveying and calculations.

Types of plans and their preparation, care, storage and preservation; legislation concerning mine plans and sections; duties and responsibilities of surveyors.

Application of computers in mine surveying and preparation of plans.

[No. Board/Coal/2009]

M.M. SHARMA, Director General of Mines Safety &
Chairman, Board of Mining Examination (Coal)

New Delhi, the 04th May, 2009

G.S.R. 67. – In pursuance of the provisions of Regulation 13(4) of the Coal Mines Regulations, 1957, the bye-laws for the conduct of examination and grant of Surveyors Certificates of Competency so far as they relate to Syllabus for Mine Surveyors Certificate Examination, (Appendix – I) being substituted by the following :-

APPENDIX – I
SYLLABUS FOR EXAMINATION FOR MINE SURVEYORS CERTIFICATES OF COMPETENCY
(Under Metalliferous Mines Regulations, 1961)
FIRST PAPER

Linear measurement :- Instruments for measuring distance ranging, chain surveying; errors in chaining and plotting; optical square.

EDM :- Principles of measurements; types; correction and selection of instrument.

Angular measurement :- Prismatic compass; bearing of lines; local attraction; magnetic declination.

Plan Table Surveying; methods contouring using plane table and micro-optic alidade.

Miners' dials and other compass instruments; dialing; loose and fast needle surveying.

Theodolite :- Modern micro-optic theodolites; measurement of horizontal and vertical angles; theodolite traversing; traverse calculation; computation of coordinates; adjustment of traverse; temporary and permanent adjustment.

Levelling :- Levelling instrument types of leveling; booking and reduction methods; temporary and permanent adjustment of levels; geometrical, trigonometric and physical leveling; characteristics and uses of contours; methods of contouring; traverse; co-ordinates and leveling problems.

Tachometry:- Controlled surveys :- Triangulation; trilateration; application of GPS and Total Station in mine surveying.

Use, care, testing, and adjustments of instruments.

SECOND PAPER

Field astronomy :- Astronomical terms; determination of true bearing by equal altitude method; Gyro theodolite; principle and determination of Gyro north, astronomical triangle; conversion of time systems and precise determination of azimuth by astronomical methods.

National grid : Map projection Cassini Lambert's polyconic and universal transfers Mercator; transformation of coordinates, vertical projections; mine models.

Geodesy :- Geod, spheroid and ellipsoid, geocentric, geodetic and astronomical coordinates, orthometric and dynamic heights.

Photogrammetry :- Introduction; scale of a vertical photograph; photographs versus maps; application of photogrammetry and remote sensing in mining.

Correlation :- Method of correlation surface and underground including Gyro-Laser combination.

Theory of errors and adjustments: Causes and classification of errors; inclines of precision; laws of weight propagation and adjustment of errors; adjustment of triangulation figures.

Surveying of flat, moderately and steeply inclined and vertical workings; control of direction and gradient in drifts and roadways; traversing along steep working with or without auxiliary telescopes.

Area and volume calculation; different methods and their limitations; earth work and building estimation; laying out of rail curves on surface and underground; measurement of depths of incline roadways and shafts; determination of azimuth latitude and longitude.

Borehole surveying and calculations; dip, strike, outcrop and fault problems.

Types of plans their preparation, care, storage and preservation; legislation concerning mine plans and sections; duties and responsibilities of surveyors.

Geological map reading.

Application of computers in mine surveying and preparation of mine plan;. 3D laser profiling of surfaces and bench walls.

[No.Board/Metal/939/2009]

M.M. SHARMA, Director General of Mines Safety &
Chairman, Board of Mining Examination (Coal)

New Delhi, the 04th May, 2009

G.S.R. 68. – In pursuance of the provisions of Regulation 13(4) of the Coal Mines Regulations, 1957, the bye-laws for the conduct of examination and grant of Overman Certificates of Competency so far as they relate to Syllabus for Overman Certificate Examination, (Appendix – I) is being substituted by the following :-

APPENDIX – I
SYLLABUS FOR EXAMINATION FOR MINE OVERMAN'S CERTIFICATES OF COMPETENCY
(Under Coal Mines Regulations, 1957)

(a) General Safety and Legislation

Duties and responsibilities of workmen, competent persons and officials (excluding managers, assistant managers); discipline amongst workers and control of staff.

Provisions of the Coal Mines Regulations, 1957, relating to mine working; explosives and shortfiring; haulage; ventilation; precautions against danger from fire, dust, gas and water and of other provisions and Rules, the enforcement of and compliance with which is the responsibility of overmen.

Writing of reports required to be made by overman under the regulations.

Dangerous occurrences in mines and dealing with the same; accidents, their causes and preventions; accident reports; not disturbing the place of accident.

Mine rescue; physiological effect of mine gases; rescue equipment and First Aid.

Sanitation and health; miners' diseases, their symptoms and preventions.

(b) Methods of Working.

Nature of occurrence of coal seams; geological disturbances and their effects on working conditions; dangers and precautionary measures while approaching geological disturbances areas. The purpose and utility of boreholes in mines; sinking; safety devices; temporary and permanent supports in sinking and working shafts; examination of shafts and outlets.

Opencast methods of mining; mechanized and manual methods; deep hole drilling and blasting; shovel and dumpers; dragline; bucket wheel excavators; surface miner; benching; maintenance of haul roads; precautions; while extracting developed pillars by opencast method and other safety precautions; methods of reclamation; dump management; high wall mining.

General principles of board and pillar and longwall method; multi-section workings; method of depillaring under different conditions; mechanized pillar extraction; precautions to be taken while working near/beneath waterlogged areas; roof convergence and convergence measuring devices etc., stone drifting.

Elements of roof control :- Rock Mass Rating (RMR) of roof strata; mechanism of rock bolting; support of roadways; face supports and their types, setting, testing and withdrawal; systematic support rules; packing and stowing; protection of surface structures; working beneath statutorily restricted areas and surface structures.

Safe handling and use of explosives; in coal and stone in gassy and non-gassy mines; simultaneous short firing; blasting in fire areas in opencast mines; safety precautions.

Inspection of workings; inspection and maintenance of haulage and travelling roadways; man riding system and return airways; gates and fences.

Reading of statutory plans.

(c) Ventilation and Precautions against Explosives: Fires and Inundation

Natural and mechanical ventilation ; ventilation of headings and sinking shafts; siting of auxiliary and booster fans; distribution, measurement and control of air in mines; estimation of air quantity requirements; methods of coursing of air; anemometer; hygrometer; maintenance of ventilation appliances.

Pollution of air; irruption/occurrence of gases in mines; properties of gases; detection and measurement of firedamp and noxious gases; sampling of air; determination of environmental condition; standards of ventilation.

Design and construction of flame and electric safety lamps; their use, examination and maintenance.

Suppression and treatment of coal dust; suitability of stone dust; sampling and analysis of mine dust.

Elementary knowledge of causes and prevention of firedamp and coal dust explosion, limits of inflammability of fire-damp.

Prevention, detection and control of spontaneous heating/fire; sealing off fire areas; fire stopping and their examination; precautions against outbreak of surface fires; fire fighting on surface and belowground.

Inspection of old workings.

Sources of danger from surface and underground water, precaution, to prevent inundation and irruption of water; precautionary measures while approaching abandoned and water logged areas, boring machines for exploratory work; water dams; water danger plan.

Recovery of mines after explosions fires and inundation; precautionary measures during re-opening and dewatering of mines.

(d) Elements of Mining Machinery.

Safety aspects and safe use of different kinds of machinery used in underground and opencast mines e.g. blast hole drills, rippers; scrappers; shovels; draglines; dumpers; road graders; dozers; wheel loaders; bucket wheel excavators; spreaders; surface continuous miners; brakes (including service and parking brakes); use of steam and internal combustion engines in mines.

Application of electricity in mines; safety precautions.

Winding equipments; ropes and guides; signaling and decking arrangements; safety devices; examination of winding equipments and shaft fittings.

Haulage and transport; types of haulage; rope haulage and locomotives; self-acting inclines; haulages; roads in underground and opencast working; rails and tracks; their maintenance and inspection; tubs; signaling; safety devices; codes of practices; traffic rules; unsafe practices; derailments.

Different types of pumps; principles and use of siphons; drainage and water lodgments.

Code of practice for transport, installation, use and shifting of underground and opencast machinery.

Belt conveyors and safety appliances.

[No.Board/Metal/940/2009]

M.M. SHARMA, Director General of Mines Safety &
Chairman, Board of Mining Examination (Coal)

Circulars – 2009

No. DGMS (Tech)/Circular No./ 01 **Dhanbad, Dated – 16/01/2009**

To,

Owner/Agent/Manager of All coal Mines and Mettalliferious mines.

Sub:- Surveyed off equipment in the open cast mine.

Investigation into the number of accidents have revealed that the accidents are increasing due to surveyed off equipments being used in opencast mines. Each company has a system of surveying off and condemning the equipment depending on the life either by number of working hours or number of years completed. Once the equipment attain the designed life, the equipment are surveyed off but the replacement has not been received. In this circumstances management has no other alternative but to use these surveyed off equipment to achieve production. During this course of time the equipment are not maintained properly and also do not get required spares causing dangerous occurrence or accidents.

In order to reduce/avert accidents and untoward incidents, the following steps are recommended to be taken before the surveyed off equipments are put into services.

1. (a) Committee consisting senior technical officer from company level, Original Equipment Manufacturer (OEM) and an independent agency shall make a through check and inspect the condition of equipment and advise the management for necessary maintenance/repairs to be carried out.

(b) The management will be strictly implement the recommendation. The equipment shall not be put into service until the recommendation are fully complied.
(c) The committee will re-inspect the equipment are recommend the period for further use of equipment.
(d) An additional periodical maintenance program shall provided by the committee.
(e) The additional periodical maintenance along with one recommended by OGM initially at one time of new installation shall be strictly followed by the mine official and a record of maintenance/inspection are recorded in a bound paged book and signed by the colliery Engineer & Manager.

2. The managements shall ensure all spares are made available for maintenance/repairs.
3. The stability of equipment shall be assessed by an independent agency in case of Excavator/Shovel and Dragline once in six months during the extended use.

I am of the opinion that the above recommendation may help in reducing incidents/accidents due to extended use of surveyed off equipments. The recommendation may be strictly complied in the interest of safety.

No. DGMS (Tech)/Circular No./ 02 Dhanbad, Dated – 09/02/2009

To,

Owner/Agent/Manager of All coal Mines and Mettalliferious mines.

Sub:- <u>Structural Safety audit for Heat gears used in Mines.</u>

Head gear is a important structure located over the shaft that houses one or two sheaves, carrying winding ropes, flexible guides and other equipments. The head frames are constantly subject to static loads, dynamic loads and environmental effect. Foundations of reinforced concrete is buried in ground and is constantly subjected to reversible loads and environmental effects, which reduces the strength of concrete an alters the properties. Failure of foundation is most dangerous for headgear frames. Hence a time to time the structural audit for safety, stability, serviceability and durability must be done to assess the damage.

Regulation 73(1) of Coal Mines Regulations, 1957 & Regulation 80(1) of Metalliferous Mines Regulation 1961 requires that "every part of a winding installation, including headgear, shall be sound construction and adequate strength, and shall be maintained in safe working order. In case of any doubt as to the foregoing, it shall be referred to the Chief Inspector of decision.

Regulation 182 of the Coal Mines Regulation, 1957 & Reg. 172 of the Metalliferous Mines Regulations 1961 require that "all parts and working gear, whether fixed or moveable, including the anchoring and apparatus used as or forming part of the equipment of a mine, and all foundations in or to which any such appliances are

anchored or fixed shall be of good construction, suitable material, adequate strength and free from visible defect and shall be properly maintained.
Head gear frame are generally not maintained for serviceability. Some of the members are removed for the convenience making structure unstable. Initial defects of fabrications of bolts, rivets are enlarged. Improper coating for protection of structure leads to corrosion of steel and reduction of properties due to environmental effects. Mishandling of structure leads also to deterioration of structure.
Durability and serviceability of head gear depends on constant watch on structure and audit for its stability. Material properties changed during service life need to be checked and identified.
Following important factors are to be carried out from time to time verified with the original.

Check to be carried out:-

1. Study the change in static and dynamic loads.
2. Evaluate change in configuration of head gear. Forces in members are to checked and a diagram to be drawn to ensure resultant failing inside back leg.
3. Joints of members are to be checked (rivets, welds, bolts)
4. Strengths of material must be ascertained by taking samples.
5. Deflection and physical movement in all direction and vibration should be measured by applying 50%, 100%, 120% loads. Deformation of frame, buckling of each individual members in joint are need to be checked. Cracks/defects shall be carefully checked.
6. Plastic stage of sections used should be checked by observing change in colour and ductility of section.
7. Ultra sound pulse velocity (N.D.T.) should be done to assess the strength cracks or defects in concrete. Concrete core may also be taken to assess the compression strength of concrete by N.D.T. Cover meter test or hammer tests may be carried out to assess the damage.

Rehabilitation of Head gear

After full condition assessment and structural audit of the head gear frame for all points mentioned above scheme of rehabilitation and bringing back to original condition shall be prepared. Scheme of retrofitting and rehabilitation will vary from mine to mine. Broadly classified items rehabilitation are mentioned below :-

1) Retrofitting of members to maintain original stable configuration of structure.
2) Bringing back to original properties of materials and section by adding additional structure member.
3) Replacement of bolts, welds, rivets and correcting the perfect alignment of member.
4) For unstable head gear frame, deflection, physical movement is corrected.
5) Apply low diffusivity coating like epoxy to whole structure surface.
6) Grout, shotcrete, inject or jacket polymer concrete to strengthen the foundation of head gear frame and fill up the cracks in the concrete.

The structural audit of head gear shall be carried out once in five year. I am sure that in the interest of safety, all mining Companies shall take immediate action to implement the above recommendations.

No. DGMS (Tech)/Circular No./ 03 Dhanbad, Dated – 6th February, 2009

To,

Owner/Agent/Manager of Coal Mines.

Sub :- Qualitative and Quantitative assessment of Fire Fighting Equipment.

Sir,

It is well known fact that air, water and fire are primary sources of lives on the earth but at the same time if the natural equilibrium of any one is disturbed then it leads to disaster and irreparable damages. Fire hazards amongst all the three are very common in the industrial as well as domestic fields.

Fire is coal mines is one of the most common hazards that lead to disasters, accidents loss of valuable lives and damages to properties. Spontaneous heating and combustion in coal is one of the major sources of fires not only in belowground workings but also in opencast mines. Bench fire in coal mine is very common apart from dump fire.

Increased mechanization and use of large number of machines of higher capacities have posed another fire threats and the incidences of fires in such machinery and installations have increased. One of the major contributors to fire is the use of electricity at higher operating voltages. The fire fighting technologies and fire suppression system have advanced further which are more fast and effective to deal with fires either on surface or belowground including heavy earth moving machinery. A few of such technology is backpacked and handheld High Pressure Water Mist cum CAFs based fire fighting system which is applicable to quench not only oil fires but even electrical fires upto 36 KV line. A live demonstration of this product was given in DGMS recently in the pressure of Officials from Coal Mining Industry, Scientist from CIMFR, Indian School of Mines and other Fire Fighting Equipment manufactures as per EN3-7 Standard B233.135 liters of diesel and 25 Liters Petrol were ignited for 60 seconds to grow the fire and flames upto its maximum intensity and then the handheld High Pressure Water Mist cum CAFs based fire fighting system was operated and applied on the fire blazing upto 30 feet height. The fire was completely quenched within 12 second which appeared to be miraculous to everyone witnessing the demonstration. Similarly, the CAFs were also applied on live electrical wires/fire which was also quenched without any difficulty.

High Pressure Water Mist cum CAFs based fire fighting system is highly effective and fast in quenching and controlling fires of varying magnitudes. A survey was recently conducted in few coal mines and installations to identify the risk of fire areas and installation based on quantitative assessment of sources of fires and its magnitude of damage.

The survey revealed that the following places, machinery and installation should be provided with at least the required number of High Pressure Water Mist cum CAFs based Fire Fighting System or such other equivalent type or even better.

Sl. No.	Location	Installation/Equipment	Fire Extinguisher's	Requirement

			Size	
1	Surface Installation	Electrical Sub-Station 33 KV	10 Liters	06
		Electrical Sub-station 11 KV	10 Liters	04
		Electrical Sub-station 550/440V	10 Liters	04
		Belt Conveyor Drive Head	10 Liters	02
		Tail-End Drum	10 Liters	01
		Transfer Point	10 Liters	01
		Belt Tensioning Point/Devices	10 Liters	01
		Belt Line where Gradient changes	10 Liters	01
		Haulage Engine Room	10 Liters	01
		Colliery Store	10 Liters	02
		Workshop	10 Liters 50 Liters	04 02
		Ventilation Fan	10 Liters	01
		Emergency Control Room	10 Liters	05
		Explosive Van	10 Liters	02
02	Opencast Mine	Dragline	50 Liters 10 Liters	01 06
		Electrical Shovel	10 Liters	04
		Electrical Drills	10 Liters	02
		Dumper	10 Liters	02
		Diesel Tankers	10 Liters	02
		Dozer	10 Liters	01
		Grader	10 Liters	01
03	Belowground	Electrical Sub-Station	10 Liters	02
		Haulage Room	10 Liters	01
		Belt Conveyor Drive Head	10 Liters	02
		Tail-End Drum	10 Liters	01
		Transfer Point	10 Liters	01
		Belt Tensioning Point/Devices	10 Liters	01
		Belt Line where Gradient changes	10 Liters	01
		Section Store	10 Liters	02
		Hydraulic Drill	10 Liters	01
		Pump House	10 Liters	01
		UG Tippler	10 Liters	01
		Load Haul Dumper (LHD)	10 Liters	01
		Side Discharge Loader	10 Liters	01
		Continuous Miner	10 Liters	02

The above estimate is based on the normal installations and machinery used in mines which may change due to extra large capacity machines installation.

It is, therefore recommended to implement the above scheme and regularly update the fire fighting plan maintained at the mine.

No. DGMS (Tech)/Circular No./ 04 Dhanbad, Dated – 16th February, 2009

To,

Owner/Agent/Manager of All Mines.

Sub :- Use of only Approved Types and Standards of Luminaries for Lighting in Mines.

Sir,

1.0 INTRODUCTION

Lighting is an essential environmental component for any working place, whether buildings, roads, offices, factories, stationery or mobile equipment, machines or any other installation and plants. It has a direct bearing on the efficiency of manpower and machine in addition to its effect on personal health. It is also well established that inadequacy of light and long exposure to inadequate lighting conditions lead to numerous eye slight problems and ill effects on human body. It is also known that over exposure to light is equally dangerous to human body.

Various researches and studies have been carried out on this subject and different standards of lighting for specified objectives and operations have been prescribed by different countries and Standard Organizations.

Bare lamps causing glare are still in frequent evidence. In many cases the quantity of light generated is sufficient, but only a small percentage of the light reaches the work, by reason of failure to equip the lamps with suitable reflectors.

"The question of artificial lighting is of special importance at the present time when night work is general, and common in mines. Notwithstanding the important bearing which good eyesight must have upon output, the question is not today receiving adequate attention at the hands of those whose duty it is to obtain this output. Bad lighting affects output unfavorably, not only by making good and rapid work more difficult, but also by causing headaches and other effects of eye-strain.

Incidence of accidents due to poor lighting conditions and glare at the eyes of the driver operating vehicles and HEMMs has also increased in recent past.

Instance have come under the notice of this Directorate, of headaches and eye-strain resulting from (a) inadequate light, both artificial and natural; (b) artificial light, adequate in amount, but so placed as to throw a glare on the eyes of the workers; (c) employment of workers, whose eyesight should be aided by suitable glasses, to carry out fine work without first testing their eyesight."

In view of the conditions prevailing at the mines and their effects on health and safety of the persons employed therein, it is imperative to re-examine the issue of lighting in the perspective of advancement made in Lighting and Photometry

that need to be applied and implemented for better work environment and safety in mines.

1.1 BACKGROUND :-

Under *regulation 151 – General Lighting,* of the Coal Mines Regulations, 1957, the adequate arrangements for providing lighting at various places both on surface as well as belowground workings of a mine have been specified. Provisions to prevent glare or eyestrain, accidental damage and Lighting Fixture to be in compliance with the Indian Electricity Rules 1956 have been specified (Regulation 152).

A Technical Committee on mining standards was appointed by the Government of India which submitted its report on Standards of Lighting in Mines in 1963. Based on the recommendations of the Committee, a technical circular no. 14 of 1964 was issued from this Directorate in which the standards of lighting for underground work places, flood lighting in depillaring areas, individuals lights, importance of lighting and eye strain due to lighting were described in details.

The Standard of Lighting for Opencast Mines were also prescribed vides Government Notification No. GSR-804 dated 18.06.1975 for Opencast Coal Mines and vide GSR No. 829 dated 18.06.1975 for Metalliferous Opencast Mines.

Various other requirement of lighting in depillaring areas in coal mines vide Technical Circular No. 42 of 1961, Flood Lighting in depillaring areas in first degree gassy seam vide Technical Circular No.36 of 1969 have also been notified.

In the standards prescribed by the notifications mentioned above, the work place lighting requirements have been mentioned. The characteristics and parameters of the luminaries required to provide the desired level of illuminations need to be defined and specified. The lighting requirements of stationery and mobile equipment signal lighting, traffic lights and many other lighting parameters also need to be looked into.

2.0 Technology Advancement

The lighting technology has advanced manifold and many lighting systems including intelligent lighting system have been developed which are not only energy efficient but also has long life of its lamps and heat sink devices. The modern lighting systems works on low voltage low current ratings and gives output more than the existing and old light fixtures like high pressure sodium vapour lamp or gas discharge systems of lights.

Glaring on the eyes of the operators and eye strains are another area of concern which lead to accidents and failures resulting in loss of lives and equipment. In number of cases, the design of the lights and its fixtures were defective and in many other cases their uses were faulty.

In this context, it is essential to study and investigate the lighting parameters provided by the Luminaire and develop a standard based on such investigations.

The life of the lights not only depends on its design and output but also on the conditions and environment in which they are used. The Dust, water, water vapour, gas, heat, shock, noise and vibrations are the primary factors that need to be taken into considerations while designing lighting systems for specified use at specified places.

The Original Lights on-boards mobile machinery are designed for a particular working conditions but during use in mines, the conditions change from mine to mine and mineral to mineral due to variations in the conditions, methods and the requirements thereon. Thus the light provided by OEM fits in properly in one mining system

whereas becomes unfit in another. The placement of light sources also plays an important role on the desired level of lighting at specified location.
A number of meetings and discussion have been held in this Directorate with the manufacturers and users of lighting systems in miners and have also seen during the course of inspections and enquires into accidents, that it is essential to focus our attention again on this subject and generate data from standardization of latest lighting systems and features which are required for mines and oilfields.

Under this varying scenario, it becomes inevitable to ensure that :-

(i) The design of light source and its technical parameters.
(ii) The spectral distribution of the light output with the type of reflector and diffuser in use,
(iii) The working conditions and the environment in which they are to be used; are clearly specified by the manufactures and should fulfill the requirements of the users.

3.0 DEFINITIONS/TERMS OF PHOTOMETRY AND IMPORTANT FACTORS

Luminaries

The complete lighting assembly, less the support assembly. For purposes of determining total light output from a luminaries, lighting assemblies which include multiple unshielded or partially shielded lamps on a single pole or standard shall be considered as a single unit.

Lumen (unit)

The **lumen** (symbol: **lm**) is the **SI** unit of luminous flux, a measure of the perceived power of light. Luminous flux differs from radiant flux, the measure of the total power of light emitted, in that luminous flux is adjusted to reflect the varying sensitivity of the human eye to different wave lengths of light. The lumen is defined in relation to the candela by

$$1\ \text{lm} = \text{cd.}\ \text{sr} = 1\ \text{lx.}\ \text{m}^2$$

That is, a light source that uniformly radiates one candela in all directions radiates a total of 4π lumens. If the source were partially covered by an ideal absorbing hemisphere, that system would radiate half as much luminous flux – only 2π lumens. The luminous intensity would still be one candela in those directions that are not obscured.

Explanation

If a light source emits one candela of luminous intensity uniformly across a solid angle of one steradian, its total luminous flux emitted into that angle is one lumen. Alternatively, an isotropic one-candela light sources emits a total luminous flux of exactly 4π lumens. The lumen can be thought of casually as a measure of the total "amount" of visible light in some defined beam or angle, or emitted from some source.

A standard 120 V, 100 watt incandescent light bulb emits 1500–1700 lumens, while a standard 230 V model emits 1200–1400 lm. A 23 watt compact fluorescent lamp emits about 1500 lm. The number of lumens produced per watt of power consumed is the wall-plug luminous efficacy of the source.

Difference between lumens and lux

The difference between the units lumen and lux is that the lux takes into account the area over which the luminous flux is spread. A flux of 1000 lumens, concentrated into an area of one square meter, lights up that square meter with an luminance of 1000 lux. The same 1000 lumens, spread out over ten square meters, produce a dimmer luminance of only 100 lux.
Achieving an luminance of 500 lux might be possible in a home kitchen with a single fluorescent light fixture with an output of 12000 lumens. To light a factor floor with dozens of times the area of the kitchen would require dozens of such fixtures. Thus, lighting a larger area to the same level of lux requires a greater number of lumens.

Luminance

It is the total amount of visible light illuminating (incident upon) a point on a surface from all directions above the surface. This "surface" can be a physical surface or an imaginary plane. Therefore luminance is equivalent to irradiance weighted with the response curve of the human eye.
Standard unit for luminance is Lux (lx), which is lumen per square meter (lm/m^2).
1 lx = 10.764 fc Footcandle : fc

Horizontal luminance

The measure of brightness from a light source, usually measured in footcandles or lumens, which is taken through a light meter's sensor at a horizontal position on a horizontal surface.

Vertical luminance
The measure of brightness from a light source, usually measured in footcandles or lumens, which is taken through a light meter's sensor at a vertical position on a vertical surface.
Uniformity Ratio

It describes the uniformity of light levels across an area. This may be expressed as a ratio of average to minimum or it may be expressed as a ratio of maximum to minimum level of illumination for a given area.
Example :- U. ratio max. to min. = 4:1 for the given area, the lowest level of illumination (1) should be no less than ¼ or "4 times less" than the maximum (4) level of illumination.
The maximum brightness contrast of juxtaposed surfaces in the normal visual field should be preferably not greater than 20 to 1; that is to say, the darkest part of the

working space observed should have brightness preferably not less than one-twentieth of that of the brightest part. If strictly local lighting is used without adequate general illumination of the workplace, the figure for brightness contrast will greatly exceed the standard given above and cause server eye-strain and increases accident hazard. When the local lighting is used there must be employed in addition a moderate intensity of overhead lighting uniformly distributed.

Standard of Distribution

Lamps should be so installed in regard to height, spacing, reflectors or other accessories, as to secure a good distribution of light on the work area, avoiding objectionable shadows and sharp contrast of intensity. The illumination on the working plane should be as uniform as possible. The variation range of illumination, that is to say the ratio of the maximum illumination to the minimum illumination, is a measure of the distribution of light and should preferably be less than 3 to 1 and not greater than 4 to 1, as relating to the machinery or work benches as the case may be. As relating to machinery and adjoining passageways the range may, of course, be much wider but should preferably not exceed 20 to 1.

Direct Illumination

Illumination resulting from light emitted directly from the lamp, off of the reflector or reflector diffuser, or through the refractor or diffuser lens, of a luminaries.

Flood or Spotlight

Any light fixture or lamp that incorporates a reflector or a refractor with a diffusing glass envelop to concentrate the light output into a directed beam in a particular direction.

Lighting Fixture

The assembly that houses the lamp or lamps and can include all or some of the following parts.

- A housing, a mounting bracket or pole socket, a lamp holder, a ballast, a reflector or mirror, and/or a refractor or lens.

Full Cut off Light Fixture

A luminaire light distribution where no light is emitted above the horizontal, and where the intensity at 80 degrees from nadir is no greater than 100 candela per 1000 lamp lumens.

Fully Shielded Light Fixture

A lighting fixture constructed in such a manner, that all light emitted by the fixture, either directly from the lamp or a diffusing element, or indirectly by reflection or refraction from any part of the luminaire, is projected below the horizontal as

determined by photometric test or certified by the manufacturer. Any structural part of the light fixture providing this shielding must be permanently affixed.

Height of Luminaire

The height of a luminaire shall be vertical distance from the ground directly below the centerline of the luminaire to the lowest direct-light-emitting part of the luminaire.

Glare

The sensation produced by a bright source within the visual field that is sufficiently brighter than the level to which the eyes are adapted to cause annoyance, discomfort, or less in visual performance and visibility.

Glare is often the result of excessive contrast between bright and dark areas in the field of view. For example, glare can be associated with directly viewing the filament of an sunshield or badly sunshield light. Light shining into the eyes of pedestrians and drivers can obscure night vision for up an hour after exposure. Caused by high contrast between light and dark areas, glare can also made it difficult for the human eye to adjust to the differences in brightness. Glare is particularly an issue in road safety, as bright and/or badly shielded lights around roads may partially blind drivers or pedestrians unexpectedly, and contribute to accidents.

Glare can also result in reduced contrast, due to light scattering in the eye by excessive brightness, or to reflection of light from dark areas in the field of vision, with luminance, similar to the background luminance. This kind of glare is a particular instance of disability glare, called **veiling glare.**

Glare can be categorized into different types.

- **Blinding glare** describes effects such as that caused by staring into the Sun. It is completely blinding and leaves temporary or permanent vision deficiencies.
- **Disability glare** describes effects such as being blinded by oncoming car lights, or light scattering in fog or in the eye, reducing contrast, as well as reflections from print and other dark areas that render them bright, with significant reduction in sight capabilities.
- **Discomfort glare** does not typically cause a dangerous situation in itself, though it is annoying an irritating at best. It can potentially cause fatigue if experienced over extended period.

Light clutter

Light clutter refers to excessive groupings of lights. Groupings of lights may generate confusion, distract from obstacles (including those that then may be intended to illuminate), and potentially cause accidents. Clutter is particularly noticeable on roads where the street lights are badly designed, or where brightly lit advertising surrounds the roadways. Depending on the motives o the persons or organizations who installed the lights, their placement and design may even be intended to distract

drivers, and can contribute to accidents. Clutter may also present a hazard in the aviation environment if aviation safety lighting must complete for pilot attention with non-relevant lighting. For instance, runway lighting may be confused with an array of suburban commercial lighting and aircraft collision avoidance lights may be confused with ground lights.

Light Pollution

Any adverse effect of man-made light.

Light Trespass

Light falling where it is not wanted or needed, typically across property boundaries.

4.0 FACTORS AFFECTING STANDARDS OF ILLUMINATION

Light level standards are affected by light quantity and quality desired, fixture efficiency and other applicable factors.

Quantity of light or the light output and light levels is measured in lumens, lux and foot-candles. Initial Lumens/Foot-candles reflect the amount of light produced by a lamp when it is installed. Supply voltage variations, lamp's interaction with the ballast and dirt build up (Luminaire Dirt Depreciation) reduce the produced amount of light. Lessening of light output over time, while continuing to consume the same energy amounts (**Lamps Lumen Depreciation)** also reduces the light levels of the lamp and waists energy.

Maintained Lumens/Foot-candles show the light level after light loss factors are taken into account over a period of time. Mean Lumens show the average light output over the lamp's lifetime. When addressing lighting standards a provision for the light quantity depreciation over time to due to multiple factors should be made.

Quality of light depends on the brightness, distribution and light color.

Photometric brightness (Luminance) is the amount of light leaving the lamp or reflecting from a surface. It is measured in foot lamberts, candles/sq. ft. and candelas/square meter (metric).

Brightness can produce levels of glare if not contained properly.

Every fixture has a **Visual Comfort Probability (VCP)** rating that reflects its levels of visual comfort.

Glare can severely interface with visual comfort. High brightness ratios produce high contrast and can also create a visual fatigue during "transient adaptation", which is the adaptation process of the eye when brightness changes.

Light color depends on the visible light spectrum and the wavelengths composition of the lamp light (Spectral power distribution), the color of the light the lamp produces

(Color temperature measured in Kelvin), the way the light source makes the color appear to human eyes and how well subtle variations in color shades are revealed (Color rendering - **Color Rendering Index** from 0-100). The higher the **CRI** is, the better the color rendition appears. An inappropriate color rendition can deceive the eye and supply it with wrong information.

Lamp examples :-

Metal Halide Lamps are High Intensity Discharge Lamps (HID) and have high efficiency and good color rendition. These lamps are used in stadiums, warehouses and industrial settings.

High Pressure Sodium Lamps (HPS) are the most efficient of the HID family. Their color rendition, however, is not as good as the rendition of Metal Halide Lamps. HPS lamps are often used for street illumination.

Fixture efficiency is affected by two factors. The first factor is the amount of power (watts W) required for the fixture to work at any given time and the amount of light leaving the fixture (Electrical Efficiency). The second is how much light will be produced by the fixture and how much of it will be task efficient (Fixture Efficiency). An inefficient fixture can use the same amount of energy as an efficient one while producing less light.

5.0 Other Criteria Affecting Standards Illumination

Activity level in the area can change the requirement of light quantity and quality depending on the function that takes place.

Visual acuity is the ability to detect a different aspect of detail. Areas that require high detail differentiation may require high visual acuity. Excessive brightness or insufficient light can hinder visual acuity.

High Light Levels and vision.

At high light levels absolute sensitivity decreases, contrast threshold increases, the eyes switch to photonic (cone vision) vision.

Object recognition depends on the ability of the eye to discriminate differences in illumination within the object and against its environment, not on how bright the scene is.

6.0 Effects of Lighting on Human Health and Psychology.

Medical research on the effect of excessive light on the human body suggests that a variety of adverse health effects may be caused by light pollution or excessive light exposure, and some lighting design textbooks use human health as an explicit criterion for proper lighting. Health effects of over-illumination or **improper spectral composition** of light may include: increased headache incidence, worker fatigue,

medically defined stress, decrease in sexual function and increase in anxiety. Common levels of fluorescent lighting in offices are sufficient to elevate blood pressure by about eight points. There is some evidence that lengthy daily exposure to moderately high lighting leads to diminished sexual performance.

Specifically within the USA, there is evidence that levels of light in most office environments leads to increased stress as well as increased worker errors.

The case against light pollution is strengthened by a range of studies on health effects, suggesting that excess light may induce loss in visual acuity, hypertension, headaches and increased incidence of carcinoma.

Where objective measurement is desired, light levels can be quantified by field measurement or mathematical modeling, with results typically displayed as ***an isophote map or light contour map.***

It is, therefore, recommended that Manger of every mien should prepare, update and maintain Lighting Plan :-

(i) *Indicating the location of the places, and the type of illuminating devices, fixtures, lamps, supports, reflectors, and other devices.*

(ii) *Description of the illuminating devices, fixtures, lamps, supports, reflectors, and other devices and the description may include, but is not limited to, catalog cuts by manufactures and drawings (including sections where required).*

(iii) *Indicating photometric data, such as that furnished by manufactures or similar showing the angle of cut off or light emissions.*

(iv) *Showing the required and exiting level of luminance at various places.*

The Mine Management shall additionally have certified reports of tests of illumination conducted by recognized testing laboratory.

7.0 General Requirements of Artificial Lighting.

The requirements for good illumination in mines, mills and other work places may be summarized as follows.

i) Sufficient illumination should be provided for each workman irrespective of his position on the working space.

ii) The lamps should be properly selected and so installed as to avoid or minimize strain on the eyes of the workmen. The type and size of lamp should be adapted to the particular location and height and class of work in question.

iii) The lamps should be operated from sources of supply which will insure continuity of service and steadiness of light.

iv) Adequate illumination should be provided from overhead lamps so that sharp shadows may be prevented as much as possible, and in such manner that individual lamps close to the work may be unnecessary except in special cases.

v) In addition to the illumination provided by overhead lamps, individual lamps should be placed close to the work if they are absolutely necessary and in such cases the lamps should be provided with suitable opaque reflectors. These requirements may now be met by means of the new types of electric, LEDs and gas lamps. However the type of lamp should be decided based on the nature of work, work environment and the extent of ambient illumination.

It is, therefore proposed that all Lighting Systems and Components in mines both on surface and belowground including oil and gas mines/fields should be of a type and standard approved in writing from the Directorate.

A notification No.N-12019/2/2009/S&T(HQ)/16 dated 13th January 2009 in this regard has been forwarded to be published in the Gazette of India and the subject matter thereof is reproduced below for information and taking necessary actions to comply with the requirement.

"In exercise of the power conferred on the Chief Inspector of Mines also designated as Director General of Mines Safety under sub-regulation (3) of Regulation of 181 of the Coal Mines Regulation, 1957 and sub-regulation (1) of Regulation of 73 of the Oil Mines Regulation, 1984, I hereby declare 1st March, 2009, as the date from which all types of lights, lighting Fixtures and systems including lights on board mobile machinery, in HEMMs, Machinery and Plants, Indicators or Signal lights to be used in mines both on surface and belowground including oil and gas mines/fields will be of such type, standard and make as approved by me by a general or special order in writing."

You are being informed in advance to take necessary steps in this regard and requested to ensure that it is implemented and complied with.

No. DGMS (Tech)/Circular No./ 05 Dhanbad, Dated – 18/02/2009

To,

Owner/Agent/Manager

Sub:- Corrections and modifications in the DGMS Technical Circular No. 9 of 2008 and Circular No. 1 of 2009

Sir,

Kindly refer to the DGMS (Technical) Circular No. 9 of 2008 and No. 1 of 2009 which were issued in connection with the modification in the conditions of permission granted under regulation 98 (1&3) of the Coal Mines Regulations 1957 and regulations 106 (2b) of the Metalliferous Mines Regulations 1961 as well as the condition for use of surveyed off equipment in Opencast mines respectively.

During the scrutiny of those circulars in this Directorate while recording, it was found that there were certain typographical errors and mistakes which have been rectified and corrected.

The corrected Circulars have now been issued with the same Circulars Numbers, therefore the Circulars issued earlier (Circular No. 9 of 2008 issued on 02.12.2008 and Circular No. 1 of 2009 issued on 16.01.2009) may kindly be replaced with these issued on 18th February 2009.

Inconvenience caused is deeply regretted.

No. DGMS (Tech)/Circular No./ 06 of 2009 Dhanbad, Dated – 12/03/2009

To,

Owner/Agent/Manager of all coal Mines.

Sub:- Use of Local Methane Detector (LMD) in underground Coal Mines.

Firedamp or Methane is the most important of the mine gases and has caused more loss of life in mines than any other gas. Methane or firedamp are synonymous to each other. Firedamp is a mixture of inflammable gases emitted from strata and besides methane, which is the principal constituent of mixture, contains higher hydrocarbons, carbon dioxide, nitrogen and water vapour. Methane mixed with air in certain proportions forms explosive mixtures. The approximate lower and upper limits of flammability of methane air mixtures are 5 and 14.8% of CH_4. Firedamp explosions have been responsible for deaths of many miners throughout the history of mining. Statistical figure indicated that during the period 1901 to 2007 there had been 37 cases of explosion (major accidents/disaster) resulting in death of 1258 persons. Lots of emphasis were given since then in detection and measurement of CH_4 concentration in mine atmosphere. Methane emission at a face is affected by factors such as type of work going on at the face and machinery used, the time of observation in relation to the cycle of work at face, the rate of coal output and face advance, barometric pressure change, variation in air velocity., method of mining and roof control and geological factors. Sudden emission of methane may occur as instantaneous coal and gas outburst, sudden emission from roof or floor strata, as gas blower from the coal seam or adjacent strata. Thus, every mine having potential hazard on methane emission should have methane monitoring system installed and maintained.

In this connection Regulation 145(1)(e) of Coal Mines Regulation 1957 says that –

(i) If the determination of inflammable gas in any ventilating district shows the percentage of inflammable gas to exceed 1.25 percent, the supply of electric energy shall be cut-off immediately from all cables and apparatus working in the district.

(ii) Again, Rule 126(4)(d) of Indian Electricity Rules, 1956 says that in any coal seam of second or third degree gassiness or in the danger zone of oil mines :-

The supplied energy shall be disconnected from all apparatus (including portable & transportable apparatus) working in the vicinity of a place where inflammable gas has been detected by the lowered flame of a flame safety lamp kept and maintained in a continuous state of illumination. The apparatus shall be interlocked with controlling switch in such a manner as to disconnect power supply automatically in the event inflammable gas exceeds 1.25% at the place. Further, if an approved apparatus for automatic detection of % of inflammable gas or vapour in addition to Flame Safety Lamp is provided in any working district or place such apparatus shall be interlocked with portable or transportable equipment.

Thus looking into the all above aspects and considering high production and mechanization, it is suggested to install a **LMD (Local Methane Detector)** which can automatically and continuously detect % inflammable gas at all mines having II/III degree gassy seams at following places :-

(i) District/Faces having continuous mining machine.
(ii) Return side of district/Longwall faces
(iii) Return airway having Electrical motors.
(iv) Main return airway.

Though the power supply in a district has to be discontinued whenever the % of inflammable gas reaches 1.25, the power to the ventilating fans (auxiliary/booster) shall be so arranged that they run continuously.

It is expected that al owner, agent and manger shall implement this circular with right spirit.

राष्ट्र की सेवा में
A century committed to the service of the nation

No. DGMS (Tech)/Circular No./ 07 **Dhanbad, Dated – 12/03/2009**

To,
Owner/Agent/Manager of all Mines.

Sub:- Safe gaps between cage and landing levels in winding shaft

An accident occurred in one of the coal mines when a work person was entering in to a cage at inset landing, he fell down in the shaft. The investigation revealed that the gap between the cage and the collar of the shaft at the inset landing was abnormally large which resulted in the accident.

Although the gap between the cage and the landing level is governed by

(a) Type of guide
(b) Gap between the guide and convincible shoe/roller.
(c) Place of landing such as at pit top, pit bottom or inter level insets.
(d) Velocity/speed of the cage.

Hence, it is recommended that in case of shaft equipped with :-

(A) **Rail/ Rigid guides.**

(i) Rail guides with shoes as connivance in cage the gap between the cage at all landing levels shall be as close as possible and not more than 50 mm.

(ii) Rail guide with roller as connivance in cage/skip the gap between the cage at all landing levels shall be as close as possible and not more than 65 mm.

(B) **Guide Rope :-**

The gap between and both at top and bottom landing shall not be more than 65mm. At inter level inset for shaft less than 100 meters in depth the gap shall be not more than 75 mm and in the shaft more than 100 meters in depth the gap shall not more than 90 mm. Further a locking device between the cage and levels gate shall also be provided for safe movement of persons.

Further it is essential that swing/flap decking devices may be provided where larger gaps are warranted and it shall overlap into the cage by at least 75mm.

In the light of above, the managements shall ensure the recommendations are strictly complied in the interest of safety.

No. DGMS (Tech)/Circular No./ 08 Dhanbad, Dated – 01/05/2009

To,

The Owner/Agent/Manager of all Coal, Mettalliferious mines and Oil Mines.

Sub:- System Study and Safety Audit for the purpose of eliminating the Risk of Accidents & Dangerous Occurrences.

You all are aware that the incidence of accidents and dangerous occurrences are taking place in every type of mines whether small or big, organized of un-organized. Ultimately, it leads to human sufferings and loss of properties. The Directorate

General of Mines Safety since its inception is trying its best to see that such occurrences do not occur and the valuable lives and properties are saved.

Whenever there occurs an accident, disaster or any dangerous occurrence, an investigation is made both at the mine management as well as DGMS level. Causes of such occurrence are found out and remedial measures suggested to prevent recurrence of such accident or disaster. However, it has been observed that such preventive measures are not properly implemented nor a recheck done in other mines to see that such situation and conditions which lead to such accidents or disaster do not exist.

When a mine becomes very large, this system to produce the required quantity of mineral also becomes complex and dynamic. In cast of such mines, it becomes necessary to study the systems in details with all its components and parameters to find out the detects or flaws. A single person or group of persons may not be well equipped to know the defects in the system, therefore it becomes necessary to engage such number of competent persons or experts on various subjects who can really find out the faults an suggest remedial measures. In such cases, it becomes a job of experts comprising of multi disciplines and subjects.

With this objectives in view, it becomes necessary to carry out Risk assessment and Safety management studies and prepare a Safety Management Plan to ensure that the risk to injuries and loss of time and properties are eliminated and kept in control. A Technical Circular No. 13 of 2002 giving details and guidelines of such studies have already been circulated in the past but the progress made on this issue in mineral and not encouraging.

Safety Audit is an integrated component of Risk Assessment and Safety Management, which is required to be undertaken every year and on occurrence of every accident or dangerous occurrence. However, it is also required that the Team which conducts such System Study and Safety Audit should comprise of eminent persons from various fields of operations and are kept updated about the latest tools and technique prevailing in the industry not only in India but world over. It has been observed many a times that a single person retired from the Industry conducts the safety audit and prepares the report entirely based on his experience and exposure without bringing in any new facts or instrument to deal with certain difficult situation and thus such studies do not yield any tangible results.

Therefore, it is recommended that :-

i) DGMS recognized Service Providers may be engaged is System Study and Safety Audit work to be under taken at any mine.
ii) Such Third Party System Study and Safety Audit (SYS-SA) should be conducted at least once in every year, after every major accident or disaster or dangerous occurrence, before implementation of any new technology or use of any new system or machinery in the mine.
iii) Such Study may be subject-wise as well as an Integrated Report of the mine incorporating all subjects such as mining, mechanical, electrical, personal, occupational Health & Hygiene, and any other subject applicable to the mine and the system prevailing or to be used therein.

iv) The Study Report should be discussed in a Tripartite Forum at Mine Level, Area Level and also at Company Level to know the high risk areas and implement the preventive measure plans so that the efforts are directed to yield desired results in timely and sustained manner.

v) One of the Inspective Officers from every discipline from DGMS should also be involved in such System Study and Safety Audit program to contribute and arrive at certain valuable decision.

vi) Annual System Study and Safety Audit Report of every mine after finalization in the Company should be submitted to DGMS for information and suggestion.

vii) The Action Taken Report on the System Study and Safety Audit Report should also be prepared and submitted to the Company as well as to DGMS including the Trade Unions having major or prominent representation in the mine.

Risk Reduction Program (RRP) is an ongoing process to achieve **Zero Harm Status of Safety** in any mien and it is expected that all the persons, organizations, unions, agencies involved directly or indirectly in mining and allied business would cooperate and help achieve this goal of the DGMS and all mining Companies.

No. DGMS (Tech)/Circular No./ 09 Dhanbad, Dated – 02/June/2009

To,

Owner/Agent/Manager of all Oil Mines and all the manufactures of flexible cables.

Sub:- <u>Use of flexible cables in drilling rigs and in other similar equipments in Oil Mines Reg.</u>

1.0 Flexible cables are in use with drilling rigs and in other similar equipments in oil mines.

2.0 The electrical equipments used in a drillings machine are high capacity DC motors, 3 phase AC motors, their control gears, light fittings and instrumentations.

3.0 Flexible cables used with circuits exceeding low voltage shall be provided with flexible metallic screening or pliable armouring.

4.0 Such flexible metallic screening if used as a means of protections from mechanical injury it shall not be used by itself to form an earth conductor, but it may be used for that purpose in conjunction with an earthing core.

5.0 Though the metallic screening shall not be used by itself to form an earth conductor the same shall have conductivity at all parts and at all joints at least equal at 50 percent of the conductivity of the largest conductor.

6.0 IS: 14494-1998 "Elastomer insulated flexible cables for use in mines-specifications" an IS 9968 Part – I & II, "Specifications for elastomer insulated cables" are the relevant Indian Standards available on elastomer insulated cables.

7.0 IS: 14494-1998 is mainly for flexible cables used in belowground and open cast mines. This standard does not cover flexible cables used in oil mines.

Though IS: 9968 (Part – I) does not speak about metallic screening for cables at voltages above low voltages, however, to afford protection against mechanical injury, it imperative that flexible cables for use in oil mines must have metallic screening also.

8.0 Hence it becomes mandatory that

(a) The flexible cables used to connect 3 phase electrical equipments shall be EPR (Ethylene Propylene Rubber [IE-2]) insulated and HOFR (heat resisting, oil resisting & flame retardant) Elastomeric CSP (Chloro-sulphonated Polyethylene) sheathed, either individually or collectively copper screened, 4 core copper conductor cables with fourth core having 50% conductivity of the largest conductor and the combined screen having 50% conductivity of the largest conductor.

(b) The flexible cables used to connect light fittings shall be EPR insulated, and HOFR elastomeric, CSP sheathed unscreened 3 core copper conductor cables.

(c) The flexible cables used with alternators & DC motors shall be single core EVA (Ethyl Vinyl Acetate Rubber) insulated and sheathed, copper conductor cables, and

(d) The flexible cables used for control connections shall be EPR insulated, and HOFR elastomeric, CSP sheathed, copper screened flexible copper conductor cables having cores upto 20 and.

Shall generally conform to IS : 9968 (Part – I)

9.0 Termination of flexible cables with electrical equipments installed in hazardous area shall be through appropriate size of double compression glands and with electrical equipments installed in non-hazardous areas shall be through a readily detachable plug and socket assembly.

No. DGMS (Tech)/Circular No./ 10 Dhanbad, Dated – 13/July/2009

To,

Owner/Agent/Manager of All Mines & The Manufactures.

Sub:- Standards Composition and properties required for Resin Capsules to be used as grouting material for Roof Bolting in Mines.

1.0 BACKGROUND

As soon as the roof in coal seam is exposed, the immediate roof starts dilating and getting detached from the overlying layers of roof strata causing it to fail if not supported properly. Roof Bolts are therefore being used as common support in underground mines all over the world along with the cement or resin grout to reinforce the strata and provide adequate support in the excavation.

It is highly desired that the roof bolts once installed should immediately start taking load of the roof strata and prevent dilation so as to eliminate changes of roof fall. Resin Grout is a very effective material which sets very fast and prevents roof dilation. Although rapid set cement capsules are also being used as grout in roof bolting, but its setting time and time to provide reinforcement in the strata is too long to arrest the roof dilation. During impending loading on the roof bolts due to stressing of the strata

also cement grout provides less resistance than the resin grout because resin has higher strengths than the cement grout.

It is, therefore necessary to have a minimum standard required for resin grout to provide desired result and fulfill the objectives to provide support in the mines.

The matter was discussed in this Directorate with the scientists from Central Institute of Mining and Fuel Research (CIMFR), Manufactures and the Users. The following Standard and Parameters have been fixed as the minimum requirements for the Resin Capsules to be used in Mines after getting approval from this Directorate.

2.0 STANDARD PARAMETERS & CHEMICAL COMPOSITION

(a) Physical Condition :-

Physical Condition of the resin capsule is an essential property for quality evaluation. The product performance depends upon the condition of the cartridges and their packaging shape & size and stiffness. The resin capsule shall have following properties:

Sl. No.	Parameters	Acceptable Limits
1	Physical Condition • Crimping – Proper Crimping at ends to prevent leakage • Hardening of the product – No hardening • Shape & Size – To be in shape and specified size	 Pass Pass Pass
2.	**Straightness :** The cartridges should be straight enough and not loose and too flexible to be difficult to push inside the hole	Pass
3	**Fragileness Test** of the double chamber Poly-tube	Pass

(b) Get Time and Setting Time :

The performance and workability of the resin capsule depend on the gel time and setting time. Gel time plays an important role in getting Physico-mechanical, properties of the resin matrix. The Gel time is defined as the period during which a resin can be mixed with no appreciable change in viscosity, i.e, before it begins to turn from fluid to Gel. Similarly, setting time is the period, in addition to gel time that is required for the resin to turn from Gel to Solid and attain enough strength.

1.	Gel Time • Fast Set • Medium Set • Slow Set	(In Seconds) 20±5 45±5 95±5
2.	Setting Time • Fast Set • Medium Set • Slow Set	(In Seconds) 10±2 12±2 20±2

Note :- Resin Capsules having different Gel and Setting Times may be manufactured and supplied for different applications as required by the User, but the capsule should have valid approval and the gel & setting times especially superscripted on the capsule.

(c) Viscosity :-

Resin matrix should be of suitable viscosity and flow which is necessary for proper mixing and grouping of the bolts. Viscosity of the resin matrix should not be too less to flow out of the hole and should not be too high to difficult to insert the MS steel bolt.

1	Viscosity (in cps)	40,000 (mins) and 60,000 (max)

(d) Acid Value :-

Acid value of the resin matrix is the presence of free acid available in the system. The availability of more quantity of free acid in the resin system will enchange the rusting characteristics of the MS Bolt. This may lead to release of MS bolt from the resin grouting material. Therefore it is necessary to keep the acid level in the resin matrix below the critical level which should not cause any damage to the MS Bolt.

1	Acid value (in mg of KOH/g)	8±2

(e) Reaction Temperatures :-

When catalyst (Hardener) is mixed with resin matrix, polymerization of the resin gets started. The reaction is exothermic and heat is generated in the resin system. The reaction temperature should not rise too high to get burning of the material. It is also observed that above 60^0C, physic-mechanical properties of the product get affected and brittleness in the casted resin is developed which reduces the strength.

In India variation of ambient temperature is very high. Therefore product should be thermally stable when stored in low and high temperature for better shelf life and workability in the underground mines.

1	Reaction Temperature (^{O}C)	Not More than 60^0 C
2	Thermal Stability • At 50^0 C for one hour • At 45^0 C for one hour	No physical & Chemical Change No physical & Chemical Change

(f) Water Resistance

Casted resin should not absorb water when immersed in water. Absorption of water develops micro-cracks in the resin that reduces the bonding properties and other physic-mechanical properties in the resin system.

1	Water absorption (7 days water	0.01 % (max)

	immersion)	

2.1 Physico-Mechanical Properties

The Physico-Mechanical Properties of the resin capsule shall conform to the following parameters and values :

1.	Compressive Strength • 30 minutes • 24 hrs	 30.0 MPa (Min.) 80.0 MPa (Min.)
2.	Bond Strength Test • 30 minutes • 24 hrs	 10.0 Tonnes 20.0 Tonnes
3.	Shot Encapsulation Test (Tonne) • 30 minutes • 24 hrs	 12.0 Tonnes 20.0 Tonnes
4	System Stiffness	20 KN/mm – System stiffness between 50 to 150 KN
5	Creep Test • Fast set at 5 KN for 25 minutes • Slow set at 20 KN for 25 minutes	(%) 0.12 (Max) 0.12 (Max)
6	Shear Test • 30 minutes • 24 hrs	 7.50 Tonnes 15.0 Tonnes
7	Elastic Modulus Test • 24 Hrs	 11.0 GPa
8	Shrinkage test At 30±2^{0}C & 65 % humidity • 24 hrs • 7 days	 0.01 1% (Max.) 0.01 1% (Max.)

2.2 Other Properties :

1	**Flammability Test** Reaction of resin system is exothermic and methane with coal dust is likely to be present in underground mines. If reaction temperature reaches above 120^{0}C by any reason, resin matrix should not catch fire. Product should be of very low flammability. The flame should cease within 10 second after removal of the product from burner after 30 second. **NOTE :- The test will be applicable within three month of issuing of this guidelines.**	Non-Flammable
2	**Toxicity** Product should not affect skin, eyes and other organs of human being during application of the product.	Non-Toxic in Nature
3	Self Life	Six Month

		(Minimum) or to be specified by the user.

2.3 Facilities Required for Quality Control at Manufacturing Unit

Sr. No.	Name of Equipment	Quantity (Nos.)	Capacity
1.	Viscometer	One	10,00,000 cps.
2.	Gel Time Measuring Apparatus	One	-
3.	Humidifier	One	Humidity 90% Temp. 5 to 50^0 C
4.	Anchorage Testing Machine	One	50 Tonnes
5.	Universal Testing Machine	One	50 Tonnes
6.	pH meter	One	0-14
7.	Stop Watch	Two	-
8.	Hot Air Oven	One	Ambient to 250^0 C
9.	Magnetic Stirrer	One	100^0 C
10.	Bunsen Burner	One	-
11.	Moulds	Different sizes	-
12.	Glassware	As per requirement	-
13.	Chemicals	As per requirement	-

3.0 SAMPLING & TESTING

In order to check the composition and required parameters during manufacture, it shall be required that the random sampling shall be collected at least 1 sample containing adequate number/quantity of resin capsules for every 10,000 pieces of resin capsule in a batch and shall be subjected to the required set of tests as prescribed at para-2.0 above and the data shall be kept recorded in a bound paged book kept for the purpose which shall be signed by the persons out the test and shall be countersigned by the quality control officer posted at the manufacturing unit (s).

3.1 The user shall carry out Physical examination tests as far as possible but shall conduct Short Encapsulation Pull Test (SEPT) for every batch of Resin capsules and keep the records in a bound paged book kept for the purpose.

In case the resin capsules fail to pass the required tests at the user end, that lot of the manufacture shall not be used and intimation thereof shall be sent to this Directorate and also to the manufacture.

Manufactures and the Users including the Test Houses, who are engaged for testing such material, are therefore requested to ensure the above mentioned Standard and Parameters before supplying and using at the mine.

No. DGMS (Tech)/Circular No./ 11 Dhanbad, Dated – 17th July 2009

To,

The Owner/Agent/Manager of All Mines & The Manufactures.

Sub:- Standards Composition and Properties of Roof Bolts to be used in Mines.

Roof Bolts are now widely being used in coal mines as well as non-coal mines to provide support in the mine workings. The steel used for the roof bolts are normally from thermo mechanically treated (TMT) rebar manufactured by various steel manufacturing companies. During the testing of some of the samples of roof bolts manufactured by some companies, it has been found that the roof bolt itself had failed and broken at 8 to 10 Tonnes Tensile Load against the requirement of at least 16 Tonnes. In some cases, the failure was brittle and sudden which indicate that the quality of steel from which the roof bolts are made, is not of the required strength and properties. The Nuts, Threads and bearing plates had also failed at very low loads. If such types of roof bolts are used in the mines, it will not provide the desired resistance and support in the strata and would lead to premature fall of roof and sides leading to accidents and fatalities.

In view of the above, the matter was discussed in detail in this Directorate and it was decided to evolve a minimum standard that is required for the roof bolt and its accessories to comply with, so that the desired support resistance is provided by the roof bolts in the mine workings.

A meeting was convened with the Scientists from Central Institute of Mining and Fuel Research (CIMFR), and the Officers of DGMS. The issues related to Standard and Parameters that is required for the roof bolts were discussed in detail and the following Standard and Parameters have been fixed as the minimum requirements for the Roof Bolts and its accessories to be used in Mines after getting approval from this Directorate:-

1.0 Physical Properties :-

Roof Bolts

(a) Shape & Size :-

The Roof bolt shall be of MS Steel or TMT Rebar having circular cross-section with ribs on circumferential region. The Roof bolt shall be as per the drawing and dimensions given by the manufacturer :-

(b) Length :-

Length of the Roof Bolt shall not be more the designed length ± 5mm.

(c) Diameter :-

Diameter of the Roof Bolt shall not be more than the designed diameter ± 0.05 mm.

(d) Straightness :-

The Roof Bolt shall be straight without any joint, welding, deviation or deflection. However if the deflection or deviation cannot avoided due to practical reason, it shall not be more than ± 0.01% per meter length of the bolt.

(e) Rib :-

The Rib of the Roof Bolt shall be as per the design of the rib with an objective to maximize the surface area without reducing the core diameter of the roof bolt and having maximum grip with the grout. However the height of the rib shall be kept within 2.5 to 5% of the core diameter of the roof bolt.

2.0 Physico-mechanical Properties ;-

(a) Steel for the Roof Bolt :-

The Roof Bolt shall be of thermo-mechanically treated (TMT) rebar manufactured from MS Grade Fe-500 or above for use with cement grout and FE-650 or above for use with resin. The Tensile Strength of Fe-500 Grade or equivalent Steel shall not be less than 500 ± 10 MPa and that of Fe-650 Grade or equivalent Steel shall not be less than 650 ± 10 Mpa respectively.

(b) Yield Strength of Steel :-

The Yield Strength of the Steel shall not be less than 10 to 20% of the Ultimate Tensile Strength (UTS).

(c) Shear Strength of Steel :-

Shear Strength of the Steel shall not be less than 50 ± 5% of the Ultimate Tensile Strength (UTS).

(d) Elongation :-

The elongation of the roof bolt under its designed load shall be within 12 to 18% of the length of the bolt.

3.0 Chemical Composition :-

Chemical Composition of the steel for manufacturing of the roof bolts varies according to the requirement of strength characteristics and specific applications given by the roof bolts manufacturer and the end user. However certain chemical

constituents of the steel which influence the required properties of steel are prescribed below:-

Sl. No.	Constituent	Percentage by Weight
1	Carbon (c)	0.3 (Max)
2	Sulfur (S)	0.06 (Max)
3	Phosphorous (P)	0.06 (Max)
4	Manganese	0.055 (Max)

Thread on the Roof Bolts :-

(a) The **thread** on the roof bolt shall be cold rolled and no cut thread shall be used. The minimum length of the thread shall be 150 ± 5 mm and the tolerance of 8g

(b) The **Nut** shall be of hexagonal shape of thickness not less than 30 mm and shall conform to IS 4218.

(c) **Pull Test :-** Thread and the Nut on the roof bolt shall be subjected to pull test which should not slip at the yield strength/load of the roof bolt.

Bearing Plate

(a) The Bearing Plate of the roof bolt shall be Dome Washer Plate of dimension 150 x 150 x 8 (minimum) mm with compatible central hole of required size and angled side to accommodate the conical seat and nut.

(b) The minimum load at which the Domed Washer Plate will become flat should be at least 14 Tonnes.

Conical Seat

(a) Conical Seat shall be of forged steel of required dimension

(b) The Conical Seat shall not deform at 30 Tonnes of load.

4.0 Tensile Test of the Roof Bolt Assembly

(a) The Roof Bolt Assembly shall be subjected to Tensile Test and should not fail up to 16 Tonnes load, in case for use with Cement Grout; and

(b) The Roof Bolt Assembly shall be subjected to Tensile Test and should not fail up to 20 Tonnes load, in case for use with Resin Grout.

Subject to the condition that System Stiffness of the Roof Bolt assembly shall be within 20 KN/mm- System stiffness between 50 to 150 KN.

5.0 Other Properties & Parameters

(a) Weather ability :-

The Roof Bolts and its components or parts shall be subjected to **Accelerated Weathering Test** in mine water condition for 20 days. No deterioration should occur on the Assembly.

(b) Accelerated Weathering Test shall also be conducted in acidic water condition for 20 days during which no deterioration should occur on the Assembly.

(c) Corrosion Resistance Test :-

The Roof Bolt Assembly shall also be subjected to Field Exposure and Corrosion Resistivity Test per IS-555: 1970 to test the resistance to corrosion of the steel of the roof bolt and its parts. The Roof Bolt should pass the required test.

6.0 SAMPLING & TESTING

In order to check the composition and required parameters during manufacture, it shall be required that the random sampling shall be collected at least 1 sample containing adequate number/quantity of roof bolts and its accessories for every 10,000 pieces of the product in a batch and shall be subjected to required set of tests as prescribed in the previous paragraphs above and the data shall be kept recorded in a bound paged book kept for the purpose which shall be signed by the persons carrying out the test and shall be countersigned by the quality control officer posted at the manufacturing unit (s).

6.1 The user shall carry out Physical examination tests as far as possible but shall conduct Tensile Test of the Assembly for every batch of Roof Bolts & its Accessories received at their end before use and keep the records in a bound paged book kept for the purpose.

In case the Roof Bolts or any of its accessories fail to pass the required tests at the user end, that lot of the manufacture shall not be used and intimation thereof shall be sent to this Directorate and also to the manufacture.

Manufactures and the Users including the Test Houses, who are engaged for testing of such material, are therefore requested to ensure the above mentioned Standard and Parameters before supplying and using at the mine.

No. DGMS (Tech)/Circular No./ 11 Dhanbad, Dated – 20th October, 2009

To,

Owner/Agent/Manager of all opencast Mines.

Sub:- <u>Provisions of Rear Vision System in Equipments</u>

Several accidents have occurred in opencast mines while reversing of equipment especially in dumpers/tippers. The manufactures provide only audio visual alarm and rear view mirrors in the equipments. Although the Audio Alarm gives warning to the

work persons, the drivers/operators does not have a clear view of the rear side of equipment. It is a practice in mines that the operator takes the assistance of a spotter while reversing. The spotters are exposed to danger of being crushed by equipment. The audio visual alarm warning at times may not provide sufficient time for the spotter and others to escape from the site and incidents/accidents takes place.

To avoid above kind of situations, it is strongly recommended that REAR VISION SYSTEM may be installed in the equipment especially in dumper/tippers. The system shall be provided with a monitor which can be installed inside the cabin of the operator and an automatic switch on the reverse gear actuates ultra low light camera with sufficient number of infra-red LEDS installed at rear of the vehicle which provide picture in nearly pitch dark and poor weather conditions and a clear and sharp picture is displayed on the monitor. The camera shall be housed in a fully water proof case which is shock and vibration resistance and suitable for high pressure washing. The two components shall be connected by a suitable detachable cable with water proof joints.

It may be noted that the above provisions is in addition to audio visual alarm and rear view mirrors which is already provided with the equipments/

It is recommended that in the interest of safety, necessary action shall be taken to provide Rear Vision System in equipments so as to eliminate the chances of accidents while reversing.

No. DGMS (Tech)/Circular No./ 13 Dhanbad, Dated – 17.11. 2009

To,

Owner/Agent/Manager of Underground Coal Mines.

Sub:- Telemonitoring System and their features for use in Underground Coal Mines.

Telemonitoring System for continuous monitoring of inflammable/toxic gases, air velocity, etc., are not new to the underground coal mines of the country. Such systems have been in use in some of the highly mechanized underground coal mines with history of high gassiness and proneness to spontaneous heating. This scenario is however slowly changing and more and more such systems are now being introduced in all such mines as an effective means to detecting inflammable/noxious gases and spontaneous heating in nascent stages, thereby enabling suitable mitigating measures to ward of likely disasters.

However, recent inspections of a large number of such installations by the officers of this Directorate revealed the dismal state of affairs as regards their installation and maintenance. Invariably, the system were found to be either faulty of non-working, thereby defeating the very purpose of their installation in difficult working situations. It was also revealed that there was no reliable mechanism to ensure the health of such installed systems on a long-term basis. The gravity of the situation was intense because of the working of such faulty system. In mines with a potential to give

misleading information on gas concentrations, etc. The consequences of such misleading information in potentially grave situation in difficult mining conditions do not need any elaboration.

As such, the matter was thoroughly deliberated upon in a tripartite technical workshop held on 9th of October, 2009 in this Directorate at Dhanbad, attended by the representatives of the management, manufacturers and this Directorate for resolving various connected issues, and the following collective decisions were arrived at.

1.0 The basic components of a Telemonitoring system :- A telemonitoring system for use in underground mines shall consist of the following as essential basic components.

- Various sensors.
- A display unit.
- Surface monitoring system for display, storage and retrieval of readings and also a warning system.
- Power supply system.
- Electrical power tripping arrangements.
- Connected data transmission cables.

2.0 Underground display unit of the telemonitoring system :- Proper display arrangements shall be provided at surface and also in the underground installation at the out-stations and with sensors. The display shall be clearly visible from a reasonable distance. The display system shall also be provided with a colour changing/blinking arrangements for indicating any recording of an environmental parameter above the pre-set value.

3.0 Various parameters of the sensors as records (a) minimum operating life of sensors, (b) working limits of temperature & relative humidity, (c) calibration including the maximum permissible deviation when tested with standard gases, frequency of calibration, availability of standard gases and various records to be maintained thereof :-

a) The minimum operating life of the sensors shall be as follows.

Sensors Type	Operating Life
CH^4 (Infrared)	5 years.
CH^4 (Catalytic)	2 years.
CH^4 (Elecro-chemical)	2 years.
CO	2 years
O^2	1 year

b) Workings limits of temperature - Not more than 50 C

Workings limits of Relative Humidity - Upto 100%

c) Calibration

(i) The deviation of the measured gas concentration shall not be more than 3% for all sensor types when tested with standard gases.

(ii) The maximum interval of calibration of sensors shall not exceed three months, alternating between the OEM and the users. However, The OEM shall examine the complete telemonitoring system in totally at least once every six months.

(iii) Adequate samples of standard gases shall be always made available at the concerned mine.

(iv) Proper records of calibrations done, duly singed by the designated officer and the Manager for the purpose, shall be maintained at the mine.

4.0 Use of the approved system in the mines :- Any sale/purchase of the continuous telemonitoring system shall be in conformity with the approved system in respect of all the basic components as mentioned above.

5.0 The minimum required power back up with the telemonitoring system:- The minimum required power backup in the event of disruption of the main electrical power supply shall be for a period of four hours.

6.0 Alarm system in the telemonitoring system :- The minimum intensity of the audio part of the audio-visual alarm provided with the telemonitoring system shall be 90 dB(A). In the underground workings, at least one audio alarm shall be provided with every out-station of the telemonitoring system.

7.0 Electrical interlocking of the telemonitoring system :- The tripping circuit of the telemonitoring system shall be electrically interlocked with the power supply system of the connected workings so as to cut off power supply when the concentration of inflammable gases measured exceeds a preset value.

8.0 Recording of telemonitoring events on surface :- Every telemonitoring installation shall be provided with an arrangements for recording and retrieving data on a continuous basis.

9.0 Maintenance of the telemonitoring system :- Every telemonitoring system shall be associated with a comprehensive Annual Maintenance Contract (AMC) with the OEM to cover both for spares and services. The period of AMC shall be not less than 5 years. The maximum response time for attending to any maintenance related problems shall not be more than 24 hours.

It is therefore, requested that the above mutually agreed recommendations are implemented strictly in respect of all telemonitoring system installed in underground coal mines. For ensuring efficient working of such systems on a long-term basic, the ISO shall have suitable time bound action plans and shall rigorously follow-up with the same.

No. DGMS (Tech)/Circular No./ 14 Dhanbad, Dated – 17.11. 2009

To,

All Owner/Agent/Manager of Underground Coal Mines.

Sub:- Use and care of Local Methane Detectors in Underground Coal Mines.

Of recent, Local Methane Detectors (LMD) are being installed in underground coal mines for monitoring the make of inflammable gases and for imitating suitable mitigating measures well in advance before the concentration assumed dangerous proportions. In this connection, a DGMS (Tech) Circular No. 6 of 2009 was issued to the industry covering a few aspect of the installation and operation of the LMDs in the mines.

However, recent inspection of such installation by the officers of this Directorate revealed that such installation are not in a position to deliver the purpose for which they were installed, on account of several reason. It was also revealed that the aforementioned DGMS (Tech) Circular No. 6 of 2009 was also not being followed in the right spirit.

This matter was viewed on a serious note and a technical workshop was organized in this Directorate at Dhanbad on the 8th of September, 2009 for extensive deliberations on the above subject. As a result of the deliberations, the following recommendations were arrived at.

1.0 Various components which make an LMD :- An LMD shall include the following as essential basic components.

- A CH^4 sensor unit
- An FLP housing for the electrical circuits and a display unit for the detected and measured CH^4 concentration. The FLP housing may be integrated with the sensor unit. The FLP housing shall be of an approved type. The FLP housing shall accommodate various arrangements for battery backup and coupling the LMD with the power supply system of the ventilating district.
- An audio-visual warning alarm unit.

2.0 The defined parameters of the life of the sensor used in the LMDs and their operating limits in terms of temperature and relative humidity :- The minimum life of a sensor used in the LMDs shall be at least three years. The sensor shall operate satisfactorily at a temperature upto 50^0 C and a relative humidity of upto 100%.

3.0 Place of installation of the LMD :- The LMD shall be installed in the main district ventilation return airway of the district, as close as practically possible to a well supported roof as may facilitate clear observation of the display unit.

4.0 The type of electrical interlinking necessary with the LMD :- Every LMD shall have a provision of a suitable outlet for coupling with the electrical supply system of the ventilating district by way of approved cables, connectors and other electrical accessories. The tripping circuit of the LMD shall be electrically interlocked with the power supply system of the connected workings so as to cut off power supply when the concentration of the measured inflammables gases exceeds a preset value.

5.0 The minimum required power back up with the LMD :- The minimum required power backup in the event of disruption of the main electrical power supply shall be for a period of 60 minutes, to be provided by a battery preferably of a rechargeable type and with a minimum life of 12 months from the date of dispatch of the battery. Wherever there is no battery backup, the same shall be incorporated within a period of six months.

6.0 The levels of Audio-visual alarm to be provided in terms of intensity :- The audio level of the audio-visual alarm shall be at least 85 dB (A). The visual alarm shall be consisting of a cluster of LEDs or other suitable arrangements as may be distinctly visible from at least two opposite directions.

7.0 The frequency of calibration of sensors and other components :- The maximum interval of calibration of the sensors shall not exceed three months, alternating between the OEM and the user. All calibrations shall be done by the OEM.

8.0 The type of back-up service required for proper up keep of the system viz-a-viz reliability :- The OEM examine the LMD in totally at least once every six months.

It is therefore, requested that the above recommendations are implemented in true spirit in respect of all installations of LMD in underground coal mines. Also, you are requested to utilize the mechanism of the Internal Safety organizations (ISO) of your respective companies to have a time bound action plan to ensure that installed LMDs are always maintained functional and in reliable conditions.

Ref:Law(HQ)/Legal-Circular/09/01 **Dated, the 20th April, 2009**

To,
All the Technical Officers,
DGMS,

Sub:- Production of Gazette Notifications such as Appointment as the Inspector of Mines/ Electrical Inspector and General authorization issued under Sec. 75 of the Mines Act-1952, whichever is applicable.

It has come to the notice of the undersigned that whenever Technical officers of this Directorate attend court for adducing evidences, in most of the cases it has been noticed that they do not carry either certified copies of the Gazette Notifications pertaining to their appointment as the Inspector and general authorizations issued under Sec. 75 of the Mines Act 1952 or original Gazettes for inspection of the courts. The non-submission/filling of the gazette notifications goes against Prosecutions (us) and accused are benefited.

It is therefore, advised to ensure that whenever any Technical officer of this Directorate being I.O./Complainant or companion Inspector (s) witness of the case attend court for adducing evidence, they must carry either the certified copies of the aforesaid notifications for its filing or original Gazettes for inspection of the Courts to prove their stand beyond any reasonable shadow of doubts.

It is further advised that the copies of the Gazette may also be enclosed along with the compliant petition at the time of its filing as well as entire contents of the Gazette as notified in the Gazette of India pertaining to (a) the appointment of Inspector of Mines/Electrical Inspector must be reproduced in toto in item No. 5.0 under heading particulars and nature of offence of compliant petition in the following manner :-

"On receiving information about the occurrence of fatal accident of …….. Colliery of M/s ……. On ……. Sri …….. DDMS/Director of Mines Safety also an Inspector of Mines under Section-5(1) of the Mines Act, 1952, or Electrical Inspector under Sec. of the Electricity Act, 2003 (whichever is applicable) as notified in the Gazette of India, which is reproduced herein under (Insert the entire contents of notifications) made an inspection and enquiry on …… to find out the cause and circumstances leading to the said accident and

(b) Under Item No. VIII, which will say "The compliant is authorized by the Chief Inspector of Mines under Sec. 75 of the Mines Act, 1952 to Institute prosecution on his behalf vide Gazette notification No.Law/G-22/07/736, dated 29th August, 2007 published in the Gazette of India, Part III, Sec. 1, dated 15th September, 2007, which reads – I

……
……
……
….. as declared under Sub-Section (3) of Section 6 of the said Act

Sd/
Chief Inspector of Mines
And Director General of
Mines Safety.

It may please by ensured that the above guidelines, whichever is applicable, in the particular case, are complied strictly while filling and attending the case in courts.

DIRECTOR GENERAL OF MINES SAFETY

No. DGMS (Tech)/Circular No./ 02 Dhanbad, Dated – 14/08/2009

To,

Owner/Agent/Manager of all Mettalliferious mines.

Sub:- Amendment in Bye-Laws in relation to syllabus for Manager's, Surveyor's, Foreman Certificate of Competency Examination under Mettalliferious Mines Regulation, 1961.

The Bye-Laws for the conduct of examinations under Mettalliferious Mines Regulation, 1961 for grant of Manager Surveyor's, Foreman Certificate of Competency as far as they relate to syllabus for examination have been amended and published under Notification Nos. G.S.R. 60 (Board/Metal/944/2009), G.S.R. 61 (Board/Metal/945/2009), G.S.R. 62 (Board/Metal/946/2009), G.S.R. 63 (Board/Metal/941/2009), G.S.R. 64 (Board/Metal/942/2009), and G.S.R. 62 (Board/Metal/943/2009) all dated 04.05.2009 in the Gazette of India, Part II – Section 3- Sub-section (i) dated 10.05.2009 – 16.05.2009.

Subject-wise revised syllabus for different certificates of competency examinations are given in Annexure enclosed.

Henceforth Manager's, Surveyor's, Foreman Certificate of Competency Examination shall be conducted in accordance with the amended provisions of the bye-laws. You are requested to bring this to the notice of all concerned.

The amended Bye-Laws are available at DGMS official website www.dgms.gov.in

APPENDIX – I
SYLLABUS FOR EXAMINATION FOR FIRST CLASS MANAGER'S CERTIFICATE OF COMPETENCY
(Under Metalliferous Mines Regulations, 1961)

(a) Winning and Working

Geology :- Characteristics and classification of mineral deposits; geological structures; folds, faults, fractures, fissures etc. methods of exploration and delineation of the ore bodies; boring through disturbed strata; bore hole survey; sampling; estimation of cut-off grade and ore reserve; losses of mineral in mining; net smelter return (NSR) to mill and mine; mine valuation; quality control, interpretation of geological maps.

Opening of mineral deposits; Legal requirement about outlets; siting; vertical and inclined shaft; adits; declines; shaft sinking and deepening; methods of sinking; mechanized sinking; in ordinary and water logged grounds, in running sand etc.; freezing, cementation and other special methods; shaft supports, temporary and permanent, tubings etc., recent developments.

Developments and layout of mines including surface and underground arrangements; layout and development of shaft-top and pit-bottom and haulage arrangements.

Underground Mining Methods; Choice of methods of developments and stopping and factors affecting the same; statutory provisions.

Primary and secondary Development; Choice of level interval and back/block length; main haulage drifts and tunnels; high speed drifting; excavation and equipping of grizzly (conventional and mechanized), ore/waste bin, main ore-pass system, underground crushing, loading and hoisting stations, underground service chambers, sump and other subsidiary excavations.

Cross-cut and drifts; raises and winzes; ground breaking; mucking; ventilation and support; extension of track and other services; modern drilling and loading equipment; Alimark and Jora-lift raising, long-hole and vertical crater retreat (VCR) raising; Raise boring systems; mechanized winzing.

Stopping :- Classification, selection of stopping methods and applicability; stope layouts, stope preparation and production operation ground breaking, mucking, ventilation, supports, haulage and dumping; stopping of narrow and wide ore bodies; mining of parallel veins; open, supported, filled and caving methods; combined systems and special methods; underhand, overhand, breast, long-hole and raise, resuing, room & pillar, sublevel, large diameter blast hole (DTH), cascade, shrinkage, vertical crater retreat, horizontal cut and fill, square set, top slicing, sub-level caving, block caving methods, combined open room, shrinkage and cut-fill and subsequent filling systems; hydraulic, thermal, hydro chemical, bio chemical and nuclear device mining system; design and construction of draw points; mechanics of draw and draw control procedure; recovery and dilution; problems of deep mining and the remedial measure; design and layout of stopes in rock burst prone mines, mining sequence and rationale.

Opencast Mining: Opening of deposits and preparation for excavation; box cut, types; selection of site; formation of production benches; ripping; types of rippers; concept of rippability and cycle of operation; drilling; blast hole drills; performance parameters; requirement of number of drills; blasting; blast design; factors influencing blast design; deep hold blasting; calculation of charge per hole; ground vibration; secondary blasting and problems of blasting side casting; environment friendly non-blasting techniques; safety aspects.

Discontinuous/cyclic methods of excavation and transport; shovel dumper operation; applicability of electric shovel and hydraulic excavators; cycle time and productivity calculation; estimation of equipment fleet; dragline operation; side casting; side cast diagram; calculation of reach; cycle time; productivity calculation; bucket capacity requirement; scrappers; types; methods of work; push pull operation etc., bucket wheel excavator; operational methods (lateral block, half block and full block etc.,) productivity calculation; continuous surface miner; operational methods (wide/full base methods, wide/full bench, block mining, stepped cut, empty travel back, turn back and continuous mining methods); conveyors; shiftable and high angle conveyors; mode of operation etc;, OITDS (operator independent truck dispatch system); in-pit crushing and strip-mining; safety aspect.

Application of concepts of Rock Mechanics for designing the methods of mining and strata control; Theories of ground movement and strata control; stress, strain, uniaxial and tri-axial strength, Poisson's Ratio, Young's Modulus, convergence, elasticity, litho static and hydrostatic pressure; rock mass classification,

strength of pillars (crown/rib/sill/post) and shaft pillar; protection of surface structures; design and stability of structures in rock; design of support and reinforcement for underground excavations support resistance, yielding and non-yielding supports, dynamic and static loading, measuring instruments, consolidated and unconsolidated fills, rock bolts, cable bolts, latest developments in mine supports, economics of support design, cost benefit analysis subsidence; caving of rock mass; problems of deep mining; rock burst; monitoring of rock mass performance; mechanics of rock fragmentation; slope stability and dump stability; dump management; roof management.

Use and safe handling of explosives; blasting techniques and their relative efficiency; total cost concept.

Application of numerical modeling in mine design application of computers in mine design and operational controls.

(b) Mine Ventilation, Explosives, Fires and Inundation

Composition of mine atmosphere; Mine gases; generation, properties and effects; sampling and analysis of mine air; flame safety lamp; monitoring of different gases; inflammability of fire damp; fire damp explosions.

Flame safety lamps and their design; use and maintenance; testing of safety lamps; lamp house and organization.

Heat and humidity :- Sources of heat in mines; geothermal gradient; heat flow in deep mines; effects of heat and humidity; psychometrics; computation of thermodynamic properties of mine air; basic modes of heat transfer in mines; methods of calculation of heat flow and temperature rise in mine airways; heat and moisture transfer in stopes; Computation of heat load due to various machines in development working and stopes e.g. drills, road headers/tunnel bores, LHDs, low profile dumpers locomotives, lump breakers, crushers, belt conveyors underground sub-stations, etc,; air cooling and conditioning.

Air flow in mines:- Laws of air flow; resistance of airways; resistance and splitting problems; equivalent orifice; flow control devices; permissible air velocities.

Natural ventilation :- Seasonal variations; calculation of natural ventilation pressure; thermodynamic principles and other short-cut methods.

Mechanical ventilation :- Theory of different fans; characteristics and suitability of fan; selection, testing and output control; fans in series and parallel; reversal of air flow; fan drift, diffuser and evasee; booster and auxiliary fans; ventilation of heading and sinking shafts; standards of ventilation; ventilation calculation.

Ventilation planning :- Ventilation layout; determination of size of shafts and airways; estimation of air quantity requirements; ventilation network analysis; Hardy Cross methods of iterative analysis and application of linear theory; thermodynamic network analysis and computer application; application of numerical modeling; estimation of pressure requirement; ventilation survey; ventilation plans.

Airbone dust :- Generation, dispersion, measurement and control; suppression and treatment of mine dust; sampling and analysis of mine dust.

Mine fires:- Types; causes; detection; prevention and control of mine fires; spontaneous heating; dealing with mine fires; sealing off fire-areas, build-up of extinctive atmosphere; fire fighting organization; reopening of sealed off fire areas.

Firedamp and sulphide dust explosion :- Cause and prevention; stone dust barrier; water barrier and other methods.

Inundation :- Causes and prevention; precautions and techniques of approaching old water logged working; safety boring apparatus; pattern of hole; design and construction of water dams; water lodgements water danger plan.

Recovery of mine after explosion, fires and inundation and investigation after the same; rescue and recovery in mines; rescue apparatus; organization of rescue work; emergency preparedness and response system.

Illumination :- Cap lamps, layout and organization of lamp rooms; standards of illumination; photometry and illumination survey.

Recent development in mine ventilation; use of numerical modeling in ventilation planning.

Risk Assessment and analysis with reference to mine environment, management of environmental risks.

(c) Mining Machinery

Strength of materials; applied mechanics; fluid mechanics.

Theory of Machines :- Machine design, different types of gears and drives, bearing, collars and joints, brakes and friction clutches, governors.

Heat engines, general outline of working principles of steam generators and auxiliary equipment, condensing plant, reciprocating steam engines, turbines, internal combustion engines, conduct of gas, oil and steam engine trial; mechanical efficiency of engines, measurement of indicated and brake horsepower.

Machine tools and workshop processes:-

Wire ropes :- Construction details, applications, mechanical properties, breaking load, factor of safety bending factor, capacity factor, snap length, critical depth inspection; examination and discarding criteria; rope capping and splicing.

Mine winders :- Types and applications components; shaft fitting; drums and sheaves; ropes and guides; drives and control systems; automatic contrivances; brakes; cage; skip; counter weight and suspension arrangement; duty cycle diagram; winder capacity and motor power calculations; equivalent mass of winder installation; safety devices; Installation; examination and testing of winding equipment.

Underground machinery :- Pneumatic and hydraulic drilling hammers, jumbo drills, Roof bolters, quadro bolters, road headers, raise climbers; tunnel, raise and shaft borers, LHDs, LPDTs, booster compressors, DTH and ITH drilling machines.

Material handling equipment in mines; Types, construction and operation; safety devices; maintenance and calculations for rope haulages; locomotives (tractive effort, draw bar pull, ideal gradient), conveyors, systems (belt conveyor, chain conveyor, cable belt conveyor, high angle conveyor, shiftable belt conveyor, pipe conveyor); scraper winches, aerial rope-ways, man riding systems; in-pit crushers, feeder breaker etc., mine cars, track design and layout; super elevation; track fitting and safety appliances; self acting inclines; ore handling plants; use of diesel equipments in underground mines.

Pumps :- Characteristics, motor power, capacity and calculations, laying of water mains, dealing with acid water; slurry, drainage; lodgements, storage, designs and layout of dams, sumps, pumping problems.

Opencast machinery :- Constructions, function and operation of blast hole drills, rippers, scrapers, shovels; draglines, dumpers, road graders, dozers, wheel loaders; bucket wheel excavators; spreaders; surface continuous miners and their maintenance aspects.

Mine electrical engineering :- Transmission and distribution of electrical power in mines; radial and ring main distribution; sub-station arrangements; short

transmission lines; cables; switch gears and protective devices; protective relays; circuit breakers; gate-end box; drill panel; field switch; transwitch; symmetrical fault and circuit breaker rating; mine signaling; power economics; industrial tariffs; power factor improvement; electrical drives and semiconductor controllers; selection of motors and starters; semiconductor devices; principles of operation of thyristor controlled variable speed electrical drives; electrical breaking; earthing; flameproof enclosures; use of high voltage operational equipment in mines.

Generation, transmission and utilization of power, steam, electricity and compressed air; air compressor and auxiliary equipment; air turbines and air engines; efficiency of power, electricity and steam systems; safety aspects.

Automation in mines :- Armchair mining (tele-operations of mining equipments)

Maintenance Systems :- Monitoring and reporting tribology – corrosion, planned maintenance, Preventive, periodical and total maintenance systems in mines. Condition based monitoring and related maintenance system.

(d) Mine Surveying

Linear measurement :- Instruments for measuring distance and ranging, units of measurement in surveying.

EDM :- Principles of measurements; types; correction and selection of instrument.

Angular measurement :- Prismatic compass; bearing of lines; local attraction; magnetic declination.

Dials; loose and fast needle surveying; plan table surveying and micro-optic alidade.

Theodolite :- Modern micro-optic theodolites; measurement of horizontal and vertical angles; theodolite traversing; traverse calculation; computation of coordinates; adjustment of traverse; temporary and permanent adjustment; tacheometry.

Lavelling :- Lavelling instruments; types of leveling; characteristics and uses of contours; methods of contouring; booking and reduction methods; shaft depth measurement; temporary and permanent adjustment of levels; problems solving.

Controlled surveys :- Triangulation; trilateration; application of GPS and Total Station in mine surveying.

Field astronomy :- Astronomical terms; determination of true bearing by equal altitude method; Gyro theodolite; principle and determination of Gyro north.

Correlation :- Methods of correlation surface and underground including Gyro-Laser combination.

Development and stone surveys :- Surveys of flat, moderately and steeply inclined and vertical workings; control of direction and gradient in drifts, tunnels, raises and winzes; traversing along steep working with or without auxiliary telescopes; 3D laser profiling of stope surfaces and bench walls.

Theory of errors and adjustments: Causes and classification of errors; inclines of precision; laws of weight; propagation and adjustment of errors; adjustment of triangulation figures.

National grid : Map projection Cassini Lambert's polyconic and universal transfers Mercator; transformation of coordinates.

Geodesy :- Geod, spheroid and ellipsoid, geocentric, geodetic and astronomical coordinates, orthometric and dynamic heights.

Astronomy :- Astronomical triangle; conversion of time systems and precise determination of azimuth by astronomical methods.

Photogrammetry :- Introduction; scale of a vertical photograph; photographs versus maps; application of photogrammetry in mining.

Area and volume calculation :- Different methods and their limitations; earth work and building estimation; laying out of rail and haul road curves, surface and underground.

Dip, strike, fault and outcrop problems, borehole surveying and calculations.

Types of plans and their preparation, care, storage and preservation; legislation concerning mine plans and sections; duties and responsibilities of surveyors.

Application of computers in mine surveying and preparation of plans.

(e) Mine Management : Legislation : Environmental Management and General Safety.

Mine Management :-

Introduction :- Evolution of management; theory and practice; principles of scientific management; elements of management function; planning; organization and control; structure and design of organization for mining enterprises.

Personal Management :- Selection; training and development of human resources for mining enterprises; leadership; study of traditional leader behavior; autocratic; democratic and Laissez-Faire behaviors.

Production Management :- Determination of norms and standards of operations by work study, analysis of mine capacities and capability; production planning, scheduling and control; short term and long term planning; productivity; concepts and measurements; application of Ergonomics in mine operation.

Financial Management :- Capital budgeting; techniques for mining project; project evaluation; payback period and IRR; methods of cost analysis and cost control; breakeven charts; working capital management.

Mining Environment:- EIA (Environment Impact Assessment), EMP (Environment Management Plan), ETP (Effluent Treatment Plant), STP (Sewerage Treatment Plant), threat to environment from underground and surface mining, means of mitigation, treatment of pollutants, monitoring systems, water management; mine closure plan; R&R (rehabilitation and re-settlement).

Economic Impact of Mining Economics of mining effect on community – before, during and after mining.

Materials Management for mining sector.

Behavioural Sciences for Management :- Conflict management; conflict in organization; sources of conflict; dealing with conflict; organizing for conflict resolution; conflict and growth; Individual motivation; two way personal communication.

Industrial Accident :- Study of human factors of industrial accidents; their causes and remedies.

Mine Legislation :-

Health and Safety Laws :- The Mines Act, 1952; Mines Rules 1955, Metalliferous Mine Regulation, 1961, Mines Rescue Rules, 1985, provisions of Indian Electricity Rules, 1956 applicable to mines; Mine Vocational Training Rules, 1966, other rules and legislation as applicable to opencast metalliferous mines.

General Safety in Mines

Safety in Mines :- Duty of care; occupational hazards of mining; causes and prevention; accidents and their classification; accident statistics; frequency rate and severity rates; cause-wise analysis, basic causes of accident occurrence; investigation into accidents and accident report; in-depth study into various causes of accidents measures for improving safety in mines; TRAP (take responsibility in accident prevention); cost of accident; safety management system; contribution of human elements in mine safety, workers participation in safety management; ISO and safety audit; safety conferences; tripartite and bipartite committees; role of information technology in safety management.

Risk Management :- Theory and application, baseline, continuous and issue based risk assessment, how they are applied to technical areas, risk management techniques, means of managing (minimizing or eliminating) risk, computer application and simulations, manager's role in risk management, due diligence, application of risk assessment and risk management with reference to due diligence.

Disaster management :- Emergency services, equipments and procedures, emergency control rooms, rescue and recovery; procedure and responsibilities, safety of persons engaged in emergency response, investigations and reports; assessment of damage, mine rescue; mine gases and their physiological effects; rescue equipments; resuscitation and reviving apparatus; selection and training for rescue work.

First aid and ambulance work.

Notified and occupational diseases; silicosis and pneumoconiosis, physiological aspects of breathing in dust laden atmosphere; dust sampling and sampling instruments; methods of counting and analysis; other mines diseases and their symptoms; preventions and treatment.

Lighting :- General principles of artificial lighting; lighting standards and their assessment.

Sanitation and health in mines.

Safety related issues in mineral beneficiation and transport.

APPENDIX – II
SYLLABUS FOR EXAMINATION FOR SECOND CLASS MANAGER'S CERTIFICATE OF COMPETENCY
(Under Metalliferous Mines Regulations, 1961)

(a) Winning and Working

Geology :- Characteristics and classification of mineral deposits; exploration and delineation of the ore bodies; boring through disturbed strata; bore hole survey; structural geology; interpretation of geological maps.

Opening of mineral deposits; vertical and inclined shaft; adits; declines; shaft sinking and deepening; methods of sinking; mechanized sinking; in ordinary and water logged grounds, other special methods; shaft supports, temporary and permanent.

Developments and layout of mines including surface and underground arrangements; layout and development of shaft-top and pit-bottom and haulage arrangements.

Underground Mining Methods; Choice of methods of developments and stopping and factors affecting the same; statutory provisions.

Primary and secondary Development; Level interval; block length; main haulage drifts high speed drifting; excavation and equipping of grizzly (conventional and mechanized), ore/waste bin, main ore-pass system, underground crushing, loading and hoisting stations, underground service chambers, sump etc.

Cross-cut and drifts; raises and winzes; ground breaking; mucking; ventilation and support; extension of track and other services; modern drilling and loading equipment; Alimak and Jora-lift raising, long-hole and vertical crater retreat (VCR) raising; Raise boring systems; mechanized winzing.

Stopping :- Classification, selection of stopping methods and applicability; stope layouts, stope preparation; production; operation ground breaking, mucking, ventilation, supports, haulage and dumping; stopping of narrow and wide ore bodies; mining of parallel veins; underhand, overhand, breast, long-hole and raise, resuing, room & pillar, sublevel, large diameter blast hole (DTH), cascade, shrinkage, vertical crater retreat, horizontal cut and fill, square set, top slicing, sub-level caving, block caving methods, combined open room, shrinkage and cut-fill and subsequent filling systems; design and construction of draw points; mechanics of draw and draw control procedure; recovery and dilution; problems of deep mining and the remedial measure; design and layout of stopes in rock burst prone mines.

Opencast Mining: Opening of deposits; preparation for excavation; box cut, types; site selection; formation of benches; rippability; types of rippers; cycle of operation; drilling; blast hole drills; performance parameters; requirement of number of drills; blasting; blast design; factors influencing blast design; deep hold blasting; calculation of charge per hole; ground vibration; secondary blasting and related problems; non-blasting techniques.

Discontinuous/cyclic methods of excavation and transport; shovel dumper operation; electric shovel and hydraulic excavators; cycle time and productivity calculation; estimation of equipment fleet; dragline operation; side casting; calculation of reach; cycle time; productivity calculation; bucket capacity requirement; scrappers bucket wheel excavator; (lateral block, half block and full block method etc.,) productivity calculation; continuous surface miner; (wide/full base, wide/full bench, block mining, stepped cut, empty travel back, turn back and continuous mining methods); conveyors; shiftable and high angle conveyors; in-pit crushing and strip-mining; safety aspect.

Application of concepts of Rock Mechanics for designing the methods of mining and strata control; Theories of ground movement and strata control; strength of pillars (crown/rib/sill/post) and shaft pillar; protection of surface structures; design and stability of structures in rock; design of support and reinforcement for underground excavations support resistance, yielding and non-yielding supports, dynamic and static loading, consolidated and unconsolidated fills, rock bolts, cable bolts, subsidence; caving of rock mass; problems of deep mining; rock burst; mechanics of rock fragmentation; slope stability and dump stability; dump management; roof management.

Use and safe handling of explosives; blasting techniques and their relative efficiency; total cost concept.

(b) Mine Ventilation, Explosives, Fires and Inundation

Composition of mine atmosphere; Mine gases; generation, properties and effects; sampling and analysis of mine air; flame safety lamp; monitoring of different gases; inflammability of fire damp.

Flame safety lamps; design; use and maintenance; testing of safety lamps; lamp house and organization.

Heat and humidity :- Sources of heat in mines; geothermal gradient; effects of heat and humidity; heat transfer in mines airways and stopes; methods of calculation of heat flow and temperature rise; heat load due to various machines; air cooling and conditioning.

Air flow in mines:- Laws of air flow; resistance of airways; resistance and splitting problems; equivalent orifice; flow control devices; permissible air velocities.

Mechanical ventilation :- Mechanical ventilators; characteristics and selection, testing and output control; fans in series and parallel; reversal of air flow; fan drift, diffuser and evasee; booster and auxiliary fans; standards of ventilation; ventilation calculation.

Ventilation planning :- Ventilation layout; determination of size of shafts and airways; estimation of air quantity requirements; ventilation network analysis; thermodynamic network analysis and computer application; estimation of pressure requirement; ventilation survey; ventilation plans.

Airbone dust :- Generation, dispersion, measurement and control; suppression and treatment of mine dust; sampling and analysis of mine dust.

Mine fires:- Types; causes; detection; prevention and control of mine fires; spontaneous heating; dealing with mine fires; sealing off fire-areas, build-up of extinctive atmosphere; fire fighting organization; reopening of sealed off fire areas.

Firedamp and sulphide dust explosion :- Cause and prevention; stone dust barrier; water barrier and other methods.

Inundation :- Causes and prevention; precautions and techniques of approaching old water logged workings; safety boring apparatus; pattern of hole; design and construction of water dams; water lodgements water danger plan.

Recovery of mine after explosion, fires and inundation and investigation after the same; rescue and recovery in mines; rescue apparatus; organization of rescue work; emergency preparedness and response system.

Illumination :- Cap lamps, layout and organization of lamp rooms; standards of illumination; photometry and illumination survey.

Recent development in mine ventilation.

(c) Mining Machinery

Strength of materials; applied mechanics; fluid mechanics.

Theory of Machines :- Machine design, different types of gears and drives, bearing, collars and joints, brakes and friction clutches, governors.

Heat engines, general outline of working principles of steam generators and auxiliary equipment, condensing plant, reciprocating steam engines, turbines, internal combustion engines, conduct of gas, oil and steam engine trial; mechanical efficiency of engines, measurement of indicated and brake horsepower.

Machine tools and workshop processes:-

Wire ropes :- Construction details, applications, mechanical properties, breaking load, factor of safety bending factor, capacity factor, snap length, critical depth inspection; examination and discarding criteria; rope capping and splicing.

Mine winders :- Types and applications components; shaft fitting; drums and sheaves; ropes and guides; drives and control systems; automatic contrivances; brakes; cage; skip; counter weight and suspension arrangement; duty cycle diagram; winder capacity and motor power calculations; equivalent mass of winder installation; safety devices; Installation; examination and testing of winding equipment.

Underground machinery :- Pneumatic and hydraulic drilling hammers, jumbo drills, Roof bolters, quadro bolters, road headers, raise climbers; tunnel, raise and shaft borers, LHDs, LPDTs, booster compressors, DTH and ITH drilling machines.

Material handling equipment in mines; Types, construction and operation; safety devices; maintenance and calculations for rope haulages; locomotives (tractive effort, draw bar pull, ideal gradient), conveyors (belt conveyor, chain conveyor, cable belt conveyor, high angle conveyor, shiftable belt conveyor, pipe conveyor); aerial rope-ways, man riding systems; in-pit crushers, feeder breaker etc., mine cars, track super elevation; track fitting and safety appliances; self acting inclines; ore handling plants; rail wagon loading plants; use of diesel equipments in underground mines.

Pumps :- Characteristics, motor power, capacity and calculations, laying of water mains, dealing with acid water; slurry, drainage; lodgements, storage, designs and layout of dams, sumps, pumping problems.

Opencast machinery :- Constructions, function and operation of blast hole drills, rippers, scrapers, shovels; draglines, dumpers, road graders, dozers, wheel loaders; bucket wheel excavators; spreaders; surface continuous miners and their maintenance aspects.

Mine electrical engineering :- Transmission and distribution of electrical power in mines; radial and ring main distribution; sub-station arrangements; short transmission lines; cables; switch gears and protective devices; protective relays; circuit breakers; gate-end box; drill panel; field switch; transwitch; symmetrical fault and circuit breaker rating; mine signaling; power factor improvement; electrical drives and semiconductor controllers; selection of motors and starters; semiconductor devices; principles of operation of thyristor controlled variable speed electrical drives; electrical breaking; earthing; flameproof enclosures; use of high voltage operational equipment in mines.

Generation, transmission and utilization of power, steam, electricity and compressed air in mines; safety aspects.

Automation in mines :- Armchair mining (tele-operations of mining equipments)

Preventive, periodical and total maintenance systems in mines.

(d) Mine Surveying

Linear measurement :- Instruments for measuring distance and ranging, units of measurement in surveying.

EDM :- Principles of measurements; types; correction and selection of instrument.

Angular measurement :- Prismatic compass; bearing of lines; local attraction; magnetic declination.

Theodolite :- Modern micro-optic theodolites; measurement of horizontal and vertical angles; theodolite traversing; traverse calculation; computation of coordinates; adjustment of traverse; temporary and permanent adjustment. Gyro theodolite principle and determination of Gyro north; determination of true bearing by equal altitude method; tacheometry.

Levelling :- Levelling instruments; types of leveling; characteristics and uses of contours; methods of contouring; booking and reduction methods; shaft depth measurement; temporary and permanent adjustment of levels.

Controlled surveys :- Triangulation; trilateration; application of GPS and Total Station in mine surveying.

Correlation :- Methods of correlation surface and underground including Gyro-Laser combination.

Development and stone surveys :- Surveys of flat, moderately and steeply inclined and vertical workings; control of direction and gradient in drifts, tunnels, raises and winzes; traversing along steep working with or without auxiliary telescopes.

Theory of errors and adjustments: Causes and classification of errors; indices of precision; laws of weight; propagation and adjustment of errors; adjustment of triangulation figures.

National grid : Map projection Cassini Lambert's polyconic and universal transfers Mercator; transformatic of coordinates.

Astronomy :- Astronomical triangle; conversion of time systems and precise determination of azimuth by astronomical methods.

Area and volume calculation :- Different methods and their limitations; earth work and building estimation; laying out of rail and haul road curves, surface and underground.

Dip, strike, fault and outcrop problems, borehole surveying and calculations.

Types of plans and their preparation, care, storage and preservation; legislation concerning mine plans and sections; duties and responsibilities of surveyors.

Application of computers in mine surveying and preparation of plans.

(e) Mine Management : Legislation : Environmental Management and General Safety.

Mine Management :-

Introduction :- Principles of scientific management; management function; planning; organization and control; structure and design of organization for mining enterprises.

Personal Management :- Selection; training and development of human resources.

Production Management :- Production planning; scheduling and control; short term and long term planning; productivity; concepts and measurements.

Environmental Management:- Mine environment monitoring and control; EMP (Environment Management Plan), mine closure plan; R&R (rehabilitation and re-settlement).

Mine Legislation :-

Health and Safety Laws :- The Mines Act, 1952; Mines Rules 1955, Metalliferous Mine Regulation, 1961, Mines Rescue Rules, 1985, provisions of Indian Electricity Rules, 1956 applicable to mines; Vocational Training Rules, 1966, other rules and legislation as applicable to opencast metalliferous mines.

General Safety in Mines

Safety in Mines :- Causes and prevention of accidents and their classification; frequency rate and severity rates; cause-wise analysis, investigation into accidents and accident report; in-depth study into various causes of accidents measures for improving safety in mines; risk assessment and risk management; cost of accident; safety management system; human elements in mine safety, workers participation in safety management; ISO and safety audit; safety conferences; tripartite and bipartite committees.

Disaster management :- rescue and recovery; mine rescue; mine gases and their physiological effects; rescue equipments; resuscitation and reviving apparatus; selection and training for rescue work.

First aid and ambulance work.

Silicosis and pneumoconiosis, physiological aspects of breathing in dust laden atmosphere; dust sampling and sampling instruments; methods of counting and analysis; other mines diseases and their symptoms; preventions and treatment.

Lighting :- General principles of artificial lighting; lighting standards and their assessment.

Sanitation and health in mines.

Safety related issues in mineral beneficiation and transport.

APPENDIX – I
SYLLABUS FOR EXAMINATION FOR MINE SURVEYORS CERTIFICATES OF COMPETENCY
(Under Metalliferous Mines Regulations, 1961)
FIRST PAPER

Linear measurement :- Instruments for measuring distance and ranging, chain surveying; errors in chaining and plotting; optical square.

EDM :- Principles of measurements; types; correction and selection of instrument.

Angular measurement :- Prismatic compass; bearing of lines; local attraction; magnetic declination.

Plan Table Surveying; methods contouring using plane table and micro-optic alidade.

Miners' dials and other compass instruments; dialing; loose and fast needle surveying.

Theodolite :- Modern micro-optic theodolites; measurement of horizontal and vertical angles; theodolite traversing; traverse calculation; computation of coordinates; adjustment of traverse; temporary and permanent adjustment.

Levelling :- Levelling instrument types of leveling; booking and reduction methods; temporary and permanent adjustment of levels; geometrical, trigonometric and physical leveling; characteristics and uses of contours; methods of contouring; traverse; co-ordinates and leveling problems.

Tachometry:- Controlled surveys :- Triangulation; trilateration; application of GPS and Total Station in mine surveying.

Use, care, testing, and adjustments of instruments.

SECOND PAPER

Field astronomy :- Astronomical terms; determination of true bearing by equal altitude method; Gyro theodolite; principle and determination of Gyro north.

National grid : Map projection Cassini Lambert's polyconic and universal transfers Mercator; transformation of coordinates, vertical projections; mine models.

Geodesy :- Geod, spheroid and ellipsoid, geocentric, geodetic and astronomical coordinates, orthometric and dynamic heights.

Astronomy :- Astronomical triangle; conversion of time systems and precise determination of azimuth by astronomical methods.

Photogrammetry :- Introduction; scale of a vertical photograph; photographs versus maps; application of photogrammetry in mining.

Correlation :- Method of correlation surface and underground including Gyro-Laser combination.

Theory of errors and adjustments: Causes and classification of errors; inclines of precision; laws of weight propagation and adjustment of errors; adjustment of triangulation figures.

Control of direction and gradient in inclined shafts, shifts, tunnels, raises and winzes; surveying of flat, moderately and steeply inclined, and vertical ore bodies.

Area and volume calculation; different methods and their limitations; earth work and building estimation; laying out of rail curves on surface and underground; measurement of depths of incline roadways and shafts; determination of azimuth latitude and longitude.

Borehole surveying and calculations; dip, strike, outcrop and fault problems.

Development sampling :- Channel and block averaging; stope sampling; averaging of stope-face boundaries; valuation of block roof tonnages; milling widths; observe plans.

Types of plans their preparation, care, storage and preservation; legislation concerning mine plans and sections; duties and responsibilities of surveyors.

Geological map reading.

Application of computers in mine surveying and preparation of plans. 3D laser profiling of bench walls in opencast mine.

APPENDIX – I
SYLLABUS FOR EXAMINATION FOR MINE FORMAN'S (UNRESTRICTED) CERTIFICATES OF COMPETENCY
(Under Metalliferous Mines Regulations, 1961)

(a) General Safety and Legislation

Duties and responsibilities of workmen, competent persons and officials (excluding managers, assistant managers); discipline amongst workers and control of staff.

Provisions of the Metalliferous Mines Regulations, 1961, relating to mine working; explosives and blasting; haulage; ventilation; precautions against danger from fire, dust, gas and water and of other provisions and Rules, the enforcement of and compliance with which is the responsibility of mine foremen.

Writing of reports required to be made by mine foreman under the regulations.

Dangerous occurrences in mines and dealing with the same; accidents, their causes and preventions; accident reports; not disturbing the place of accident.

Mine rescue; physiological effect of mine gases; rescue equipment and First Aid.

Sanitation and health; miners' diseases, their symptoms and preventions.

(b) Methods of Working.

Nature of occurrence of mineral deposits; geological disturbances and their effects on working conditions; dangers and precautionary measures while approaching geological disturbances areas.

The purposes and utility of boreholes in mines; shaft sinking; safety devices; temporary and permanent supports in sinking and working shafts; estimation of shafts and outlets.

Opencast methods of mining; mechanized and manual methods; deep hole drilling and blasting; shovel and dumpers; dragline; bucket wheel excavators; surface continuous miner; benching; maintenance of haul roads; other safety precautions; methods of reclamation; dump management.

General principles of primary and secondary development; stopping methods; manual and mechanized stone drifting.

Elements of roof control; mechanism of rock bolting; support of roadways; face supports and their types, setting, testing and withdrawal; systematic timbering rules; packing and stowing; protection of surface structures; working beneath statutorily restricted areas and surface structures.

Safe handling and use of explosives; deep hole drilling and blasting; safety precautions.

Inspection of workings; inspection and maintenance of haulage and travelling roadways; man riding system and return airways; gates and fences.

Reading of statutory plans.

(c) Ventilation and Precautions against Explosives: Fires and Inundation

Natural and mechanical ventilation ; ventilation of headings and sinking shafts; siting of auxiliary and booster fans; distribution, measurement and control of air in mines; estimation of air quantity requirements; methods of coursing of air; anemometer; hygrometer; maintenance of ventilation appliances.

Pollution of air; irruption/occurrence of gases in mines; properties of gases; detection and measurement of firedamp and noxious gases; sampling of air; determination of environmental condition; standards of ventilation.

Design and construction of flame and electric safety lamps; their use, examination and maintenance.

Suppression and treatment, sampling and analysis of mine dust.

Elementary knowledge of causes and prevention of firedamp and sulphide dust explosion, limits of inflammability of fire-damp.

Fires and spontaneous heating; prevention, detection and control of mine fire; sealing off fire areas; fire stopping and their examination; precautions against outbreak of surface fires; fire fighting on surface and belowground.

Inspection of old workings.

Sources of danger from surface and belowground water, precaution, to prevent inundation and irruption of water; precautionary measures while approaching abandoned and water logged areas, boring machines for exploratory work; water dams; water danger plan.

Recovery of mines after explosions fires and inundation; precautionary measures during re-opening and dewatering of mines.

(d) Elements of Mining Machinery.

Safety aspects and safe use of different kinds of machinery used in underground and opencast mines including blast hole drills, rippers; scrappers; shovels; draglines; dumpers; road graders; dozers; wheel loaders; bucket wheel excavators; spreaders; surface continuous miners; brakes (including service and parking brakes); generation and use of compressed air; use of steam and internal combustion engines in mines.

Application of electricity in mines; safety precautions.

Winding equipments; ropes and guides; signaling and decking arrangements; safety devices; examination of winding equipments and shaft fittings.

Haulage and transport; types of haulage; rope haulage and locomotives; self-acting inclines; haulages; roads in underground and opencast working; rails and tracks; their maintenance and inspection; tubs; signaling; safety devices; codes of practices; traffic rules; unsafe practices; derailments.

Different types of pumps; principles and use of siphons; drainage and water lodgments.

Code of practice for transport, installation, use and shifting of underground and opencast machinery.

Belt conveyors and safety appliances.

No. DGMS (Tech)/Circular No./ 03 hanbad, Dated – 14/08/2009

To,

Owner/Agent/Manager of all Coal Mines.

Sub:- Amendment in Bye-Laws in relation to subject & syllabus for Manager's, Surveyor's, Overman Certificate of Competency Examination under Coal Mines Regulation, 1957.

The Bye-Laws for the conduct of examinations under Coal Mines Regulation, 1957 for grant of Manager Surveyor's, Overman Certificate of Competency as far as they relate to syllabus for examination have been amended and published under Notification Nos. G.S.R. 66 (Board/Coal/2009), G.S.R. 67 (Board/Coal/939/2009), and G.S.R. 68 (Board/Coal/940/2009) all dated 04.05.2009 in the Gazette of India, No. 17, Part II – Section 3- Sub-section (i) dated 10.05.2009 – 16.05.2009.

The main features of the amendment are as follows :-

A. The subjects for managers competency examination under the Coal Mines Regulation 1957 :-

Certificate of Competency	Bye Law No.	Existing Provisions	Substituted Provisions
Managers Certificate of Competency	5	Subjects and syllabus for Examinations (a) Winning and Workings. (b) Mine Management (c) Mine Ventilation, Explosions, Fires and Inundation (d) Mine Surveying	Subjects and syllabus for Examinations (a) Mine Management (b) Winning and Workings. (c) Mine Ventilation, Explosions, Fires and Inundation (d) Mining Machinery

		(e) Mining Machinery	and Electricity. (e) Mine Surveying

B. Subject wise revised syllabus for different certificates of competency examinations are given in Annexure enclosed.

Henceforth, Manager's, Surveyor's, Overman Certificate of Competency Examination shall be conducted in accordance with the amended provisions of the bye-laws. You are requested to bring this to the notice of all concerned.

The amended Bye-laws are available at DGMS official website. www.dgms.gov.in

APPENDIX-I
SYLLABUS FOR THE EXAMINATION FOR FIRST CLASS MANAGER'S CERTIFICATE OF COMPETENCY
(Under Coal Mines Regulations, 1957)

(a) Mine Management : Legislation and General Safety.

Mine Management :-

Introduction :- Evolution of management; theory and practice; principles of scientific management; elements of management function; planning; organization and control; structure and design of organization for mining enterprises.

Personal Management and Organizational behavior Selection; training and development of human resources for mining enterprises; leadership; study of traditional leader behaviour; autocratic; democratic and Laissez-Faire behaviors; conflict management; conflict in organization; sources of conflict; dealing with conflict; organizing for conflict resolution; conflict and growth individual motivation; two way personal communication.

Production Management :- Determination of norms and standards of operations by work study, analysis of mine capacities and capability; production planning, scheduling and control; short term and long term planning; productivity; concepts and measurements; application of Ergonomics in mine operation.

Financial Management :- Capital budgeting; techniques for mining project; project evaluation; payback period and IRR; methods of cost analysis and cost control; breakeven charts; working capital management; ERP (Enterprise Resources Planning).

Mining Environment:- EIA (Environment Impact Assessment), EMP (Environment Management Plan), ETP (Effluent Treatment Plant), STP (Sewerage Treatment Plant), threat to environment from underground and surface mining, means of mitigation, treatment of pollutants, monitoring systems, water management; mine closure plan; R&R (rehabilitation and re-settlement).

Economic Impact of Mining Economics of mining effect on community – before, during and after mining corporate social responsibility (CSR).

Materials Management for mining sector; ABC analysis, Inventory Management.

Industrial Accident :- Study of human factors of industrial accidents; their causes and remedies.

Mine Legislation :-

Health and Safety Laws :- The Mines Act, 1952; Mines Rules 1955, Coal Mine Regulation, 1957, Mines Rescue Rules, 1985, provisions of Indian Electricity

Rules, 1956 applicable to mines; Mine Vocational Training Rules, 1966, other rules and legislation as applicable to opencast metalliferous mines.

General Safety in Mines

Safety in Mines :- Duty of care; occupational hazards of mining; causes and prevention; accidents and their classification; accident statistics; frequency rate an severity rates; cause-wise analysis, basic causes of accident occurrence; investigation into accidents and accident report; in-depth study into various causes of accidents measures for improving safety in mines; TRAP (take responsibility in accident prevention); cost of accident; safety management system; contribution of human elements in mine safety, workers participation in safety management; ISO and safety audit; safety conferences; tripartite and bipartite committees; role of information technology in safety management.

Risk Management :- Theory and application, baseline, continuous and issue based risk assessment, risk management techniques and application, means of managing (minimizing or eliminating) risk, computer application and simulations, manager's role in risk management, due diligence, application of risk assessment and risk management with reference to due diligence.

Disaster management :- Emergency services, equipments and procedures, emergency control rooms, rescue and recovery; procedure and responsibilities, safety of persons engaged in emergency response, investigations and reports; assessment of damage, mine rescue; mine gases and their physiological effects; rescue equipments; resuscitation and reviving apparatus; selection and training for rescue work.

First aid and ambulance work.

Notified and occupational diseases; silicosis and pneumoconiosis, physiological aspects of breathing in dust laden atmosphere; dust sampling and sampling instruments; methods of counting and analysis; other mines diseases and their symptoms; preventions and treatment.

Lighting :- General principles of artificial lighting; lighting standards and their assessment.

Sanitation and health in mines.

Safety related issues in mineral beneficiation and transport.

(b Winning and Working

Geology :- Nature and occurrence of coal seams; description of Indian coalfields; application of geology to mining; geological structures; folds, faults, fractures, fissures etc. boring through disturbed strata; bore hole survey; indicated and proved coal reserves; interpretation of geological maps.

Opening of coal seams: Legal requirement about outlets; siting; vertical shaft; inclines shaft; inclines; shafts sinking and deepening; drift drivage; mechanized sinking; in ordinary and water logged grounds, in running sand etc.; freezing, cementation and other special methods; shaft supports, temporary and permanent, tubings etc., recent developments.

Developments and layout of mines including surface and underground arrangements; layout and development of shaft-top and pit-bottom and haulage arrangements.

Underground Mining Methods; Choice of methods of mining coal seams and factors affecting the same; statutory provisions.

Board and Pillar method :- Schemes of development; design of bord and pillar working; statutory provisions selection of equipment for development mechanized loaders, continuous miners etc., preparatory arrangement for depillaring; statutory

provision for depillaring; designing the system of pillar extraction with caving and stowing; mechanization in depillaring operation; types of loading machines; continuous miners etc.; roof management; local fall and main fall; indications of roof weighting; air blasts and precautions against the same; precautions against fire and inundation during depillaring; multi-section and contiguous working; liquidation of developed pillars.

Longwall mining :- Method of driving gate roads; single and multiple heading gate roads; longwall face layout advancing and retreating faces; orientation of longwall face; support system for longwall gate roads; powered support; face transfer, operation of shearer and plough; roof management and hard roof management; periodic and main fall; design of high productive longwall panel; mini/short wall mining; communication and telemonitoring.

Thick seam mining :- Board and pillar and longwall methods in multi-section; multi-slice methods; inclined slicing; horizontal slicing and cross slicing in ascending and descending orders; under winning methods; sublevel caving; integral caving; blasting gallery and descending shield methods; hydraulic mining; special methods of thick seam mining.

Other special methods of mining :- Wide stall method; methods of mining thin seams; underground coal gasification, coal bed methane/ coal mine methane etc.

Opencast Mining: Opening of deposits and preparation for excavation; box cut, types; selection of site; formation of production benches; ripping; types of rippers; concept of rippability and cycle of operation; drilling; blast hole drills; performance parameters; requirement of number of drills; blasting; blast design; factors influencing blast design; deep hold blasting; calculation of charge per hole; ground vibration; secondary blasting and problems of blasting side casting; environment friendly non-blasting techniques; safety aspects.

Discontinuous/cyclic methods of excavation and transport; shovel dumper operation; applicability of electric shovel and hydraulic excavators; cycle time and productivity calculation; estimation of equipment fleet; dragline operation; side casting; side cast diagram; calculation of reach; cycle time; productivity calculation; bucket capacity requirement; scrappers; types; methods of work; push pull operation etc., bucket wheel excavator; operational methods (lateral block, half block and full block etc.,) productivity calculation; continuous surface miner; operational methods (wide/full base methods, wide/full bench, block mining, stepped cut, empty travel back, turn back and continuous mining methods); conveyors; shiftable and high angle conveyors; mode of operation etc;, OITDS (operator independent truck dispatch system); in-pit crushing and strip-mining; opencast mining over developed coal seams; high-wall mining; safety aspect.

Application of concepts of Rock Mechanics for designing the methods of mining and strata control; Theories of ground movement and strata control; stress, strain compressive and tensile, shear strength uniaxial and tri-axial strength, Poisson's Ratio, Young's Modulus, convergence, elasticity, lithostatic and hydrostatic pressure; rock mass classification, strength of stooks; shaft pillar; protection of surface structures; design and stability of structures in rock; design of support and reinforcement for underground excavations support resistance, yielding and non-yielding supports, dynamic and static loading, measuring instruments, consolidated and unconsolidated fills, rock bolts, cable bolts, latest developments in mine supports, economics of support design, subsidence; caving of rock mass; bumps; monitoring of

rock mass performance; mechanics of rock fragmentation; slope stability and dump stability; dump management; roof management.

Development of safe explosives; permitted explosives; composition and testing of safe explosives Milli-second detonators; alternatives of explosives. Use and safe handling of explosives in coal and stone drivages in gassy and non-gassy mines, blasting techniques and their relative efficiency, total cost concept.

Application of numerical modeling in mine design application of computers in mine design and operational controls.

(c) Mine Ventilation, Explosives, Fires and Inundation

Composition of mine atmosphere; Mine gases; generation, properties and effects; sampling and analysis of mine air; methane content; methane drainage; flame safety lamp; methanometers and multi-gas detectors; gas chromatograph; methane layering; monitoring of different gases; telemonitoring; coal bed methane/coal mine methane.

Heat and humidity :- Sources of heat in mines; geothermal gradient; heat flow in deep mines; effects of heat and humidity; psychometrics; computation of thermodynamic properties of mine air; basic modes of heat transfer in mines; methods of calculation of heat flow and temperature rise in mine airways; heat and moisture transfer in bord and pillar and longwall workings; Computation of heat load due to various machines e.g. belt conveyor, power pack stage loader, lump breaker, armoured flexible conveyor, shearer etc. in longwall gate roads and face and road header, continuous miner and underground sub-stations etc. in the mine; air cooling and conditioning.

Air flow in mines:- Laws of air flow; resistance of airways; resistance and splitting problems; equivalent orifice; flow control devices; permissible air velocities.

Natural ventilation :- Seasonal variations; calculation of natural ventilation pressure; thermodynamic principles and other short-cut methods.

Mechanical ventilation :- Theory of different fans; characteristics and suitability of fan; selection, testing and output control; fans in series and parallel; reversal of air flow; fan drift, diffuser and evasee; booster and auxiliary fans; ventilation of heading and sinking shafts; standards of ventilation; ventilation calculation.

Ventilation planning :- Ventilation layout; determination of size of shafts and airways; estimation of air quantity requirements; ventilation network analysis; Hardy Cross methods of iterative analysis and application of linear theory; thermodynamic network analysis and computer application; application of numerical modeling; estimation of pressure requirement; ventilation survey; recent development in mine ventilation, ventilation plans.

Airbone dust :- Generation, dispersion, measurement and control; suppression and treatment of mine dust; properties of stone dust; sampling and analysis of coal dust.

Mine fires:- Cause of mine fires, spontaneous combustion, mechanism and susceptibility indices detection and prevention of spontaneous heating and mine fires; dealing with mine fires; sealing off fire-areas; build-up of extinctive atmosphere; pressure balancing; fire fighting organization; gas ratios and their limitations; modified gas ratios; reopening of sealed off fire areas; fires in quarries over developed pillars; coal stack and waste dump fires.

Mine explosions :- Fire damp and coal dust explosions; cause and prevention; stone dust barrier; water barrier and other methods.

Explosion in quarries over developed pillars. Water gas explosion.

Inundation :- Causes and prevention; precautions and techniques of approaching old water logged working; safety boring apparatus; pattern of hole; design and construction of water dams; water lodgements; monsoon preparations, water danger plan.

Recovery of mine after explosion, fires and inundation rescue and recovery in mines; rescue apparatus; organization of rescue work; emergency preparedness and response system.

Illumination :- Cap lamps, layout and organization of lamp rooms; standards of illumination; photometry and illumination survey.

Risk Assessment and analysis with reference to mine environment, management of environmental risks.

(d) Mining Machinery and Electricity

Theory of Machines :- Machine design, different types of gears and drives, bearing, collars and joints, brakes and friction clutches, governors.

Heat engines, general outline of working principles of steam generators and auxiliary equipment, condensing plant, reciprocating steam engines, turbines, internal combustion engines, conduct of gas, oil and steam engine trial; mechanical efficiency of engines, measurement of indicated and brake horsepower.

Machine tools and workshop processes:-

Wire ropes :- Construction details, applications, mechanical properties, breaking load, factor of safety bending factor, capacity factor, snap length, critical depth inspection; examination and discarding criteria; rope capping and splicing.

Mine winders :- Types and applications components; shaft fitting; drums and sheaves; ropes and guides; drives and control systems; automatic contrivances; brakes; cage; skip; counter weight and suspension arrangement; duty cycle diagram; winder capacity and motor power calculations; equivalent mass of winder installation; safety devices; Installation; examination and testing of winding equipment, non destructive testing.

Underground machinery :- Coal drills; jumbo drills; roof bolters; quad bolters; UDM; shearers; ploughs; AFC; road headers; ding headers; continuous miners; shuttle cars; SDLs; LHDs.

Material handling equipment in mines; Types, construction and operation; safety devices; maintenance and calculations for rope haulages; locomotives (tractive effort, draw bar pull, ideal gradient), conveyors, systems (belt conveyor, chain conveyor, cable belt conveyor, high angle conveyor, shiftable belt conveyor, pipe conveyor); aerial rope-ways, man riding systems; in-pit crushers, feeder breaker etc., mine cars, track design and layout; super elevation; track fitting and safety appliances; self acting inclines; coal handling plants; rail wagon loading; plants; use of diesel equipments in underground coal mines, free steered vehicles.

Pumps :- Types, Characteristics, motor power, capacity and calculations, laying of water mains, dealing with acid water; slurry, drainage; lodgements, storage, designs and layout of dams, sumps, pumping problems.

Opencast machinery :- Constructions, function and operation of blast hole drills, rippers, scrapers, shovels; draglines, dumpers, road graders, dozers, wheel

loaders; bucket wheel excavators; spreaders; surface continuous miners and their maintenance aspects.

Generation, transmission and utilization of power, steam, compressed air; air compressor and auxiliary equipment; air turbines and air engines; efficiency of power, electricity and steam systems; safety aspects.

Maintenance Systems :- Monitoring and reporting tribology – corrosion, planned maintenance, Preventive, periodical and total maintenance systems in mines. Condition based monitoring and related maintenance system.

Mine electrical engineering :- Generation, Transmission and distribution of electrical power in mines; radial and ring main distribution; power economics; industrial tariffs; power factor improvement; sub-station arrangements; short transmission lines; cables; switch gears and protective devices; protective relays; circuit breakers; gate-end box; drill panel; field switch; transwitch; symmetrical fault and circuit breaker rating; mine signaling; electrical drives and semiconductor controllers; selection of motors and starters; semiconductor devices; principles of operation of thyristor controlled variable speed electrical drives; electrical breaking; earthing; flameproof enclosures and intrinsic safety; use of high voltage operational equipment in mines.

(e) Mine Surveying

Linear measurement :- Instruments for measuring distance and ranging, units of measurement in surveying.

EDM :- Principles of measurements; types; correction and selection of instrument.

Angular measurement :- Prismatic compass; bearing of lines; local attraction; magnetic declination.

Dials; loose and fast needle surveying; plan table surveying and micro-optic alidade.

Theodolite :- Modern micro-optic theodolites; measurement of horizontal and vertical angles; theodolite traversing; traverse calculation; computation of coordinates; adjustment of traverse; temporary and permanent adjustment; tacheometry.

Levelling :- Levelling instruments; types of leveling; characteristics and uses of contours; methods of contouring; booking and reduction methods; shaft depth measurement; temporary and permanent adjustment of levels; problems solving.

Controlled surveys :- Triangulation; trilateration; application of GPS and Total Station in mine surveying.

Field astronomy :- Astronomical terms; determination of true bearing by equal altitude method; Gyro theodolite; principle and determination of Gyro north. Astronomical triangle; conversion of time system and precise determination of azimuth by astronomical methods.

Correlation :- Methods of correlation surface and underground including Gyro-Laser combination.

Development and stone surveys :- Surveys of flat, moderately and steeply inclined and vertical workings; control of direction and gradient in drifts and roadways traversing along steep working with or without auxiliary telescopes; 3D laser profiling of bench walls.

Theory of errors and adjustments: Causes and classification of errors; inclines of precision; laws of weight; propagation and adjustment of errors; adjustment of triangulation figures.

National grid : Map projection Cassini Lambert's polyconic and universal transfers Mercator; transformation of coordinates.

Geodesy :- Geod, spheroid and ellipsoid, geocentric, geodetic and astronomical coordinates, orthometric and dynamic heights.

Photogrammetry :- Introduction; scale of a vertical photograph; photographs versus maps; application of photogrammetry and remote sensing in mining.

Area and volume calculation :- Different methods and their limitations; earth work and building estimation; laying out of rail curves and haul road curves, surface and underground.

Dip, and strike problems; outcrop problems; borehole surveying and calculations.

Types of plans and their preparation, care, storage and preservation; legislation concerning mine plans and sections; duties and responsibilities of surveyors.

Application of computers in mine surveying and preparation of plans.

APPENDIX – II
SYLLABUS FOR THE EXAMINATION FOR SECOND CLASS MANAGER'S CERTIFICATE OF COMPETENCY
(Under Coal Mines Regulation, 19570

(a) Mine Management : Legislation : and General Safety.

Mine Management :-

Introduction :- Principle of scientific management; management functions; planning; organization and control; structure and design of organization for mining enterprises.

Personal Management:- Selection; training and development of human resources for mining enterprises;

Production Management :- Production planning, scheduling and control; short term and long term planning; productivity; and its measurements.

Environmental Management :- Mine Environment monitoring and control; EMP (Environment Management Plan); mine closure plan; R&R (rehabilitation and resettlement).

Mine Legislation :-

Health and Safety Laws :- The Mines Act, 1952; Mines Rules 1955, Coal Mine Regulation, 1957, Mines Rescue Rules, 1985, provisions of Indian Electricity Rules, 1956 applicable to mines; Vocational Training Rules, 1966, other rules and legislation applicable to coal mines.

General Safety in Mines

Safety in Mines :- Causes and prevention of accidents and their classification; accident statistics; frequency rate an severity rates; cause-wise analysis, investigation into accidents and accident report; in-depth study into various causes of accidents measures for improving safety in mines; risk assessment and risk management; cost of accident; safety management system; human elements in mine safety, workers participation in safety management; ISO and safety audit; safety conferences; tripartite and bipartite committees.

Disaster management :- rescue and recovery; mine rescue; mine gases and their physiological effects; rescue equipments; resuscitation and reviving apparatus; selection and training for rescue work.

First aid and ambulance work.

Notified and occupational diseases; silicosis and pneumoconiosis, physiological aspects of breathing in dust laden atmosphere; dust sampling and sampling instruments; methods of counting and analysis; other mines diseases and their symptoms; preventions and treatment.

Lighting :- General principles of artificial lighting; lighting standards and their assessment.

Sanitation and health in mines.

Safety related issues in mineral beneficiation and transport.

(b) Winning and Working

Geology :- Nature and occurrence of coal seams; description of Indian coalfields; geological features of coalfields; methods of boring; boring through disturbed strata; bore hole survey; interpretation of geological maps.

Opening of coal seams: shafts sinking and drift drivage; methods of sinking; mechanized sinking; in ordinary and water logged grounds, and other special methods; shaft supports, temporary and permanent; mechanized stone drifting etc.

Developments and layout of mines including surface and underground arrangements; layout and development of shaft-top and pit-bottom and haulage arrangements.

Underground Mining Methods; Choice of methods of mining coal seams and factors (depth, seam thickness, inclination etc.) affecting the same; statutory provisions.

Board and Pillar method :- design of bord and pillar working; statutory provisions mechanized loaders, continuous miners etc., depillaring and applicable statutory provision pillar extraction with caving and stowing; mechanization in depillaring; local fall and main fall; indications of roof weighting; air blasts and precautions against the same; precautions against fire and inundation; multi-section and contiguous working.

Longwall mining :- Method of driving single and multiple heading gate roads; orientation of longwall face; advancing and retreating faces; support system for longwall gate roads; powered support; face transfer, operation of shearer and plough; periodic and main fall; mini/short wall mining; communication and telemonitoring.

Thick seam mining :- Board and pillar and longwall methods in multi-section; multi-slice methods; inclined slicing; horizontal slicing and cross slicing in ascending and descending orders; under winning methods; sublevel caving; integral caving; blasting gallery and descending shield methods; hydraulic mining; special methods of thick seam mining.

Other special methods of mining :- Wide stall method; methods of mining thin seams; underground coal gasification, coal bed methane/ coal mine methane etc.

Opencast Mining: Opening of deposits and preparation for excavation; box cut, types; site selection; formation of benches; rippability; types of rippers; cycle of operation; drilling; blast hole drills; performance parameters; requirement of number of drills; blasting; blast design; factors influencing blast design; deep hold blasting; calculation of charge per hole; ground vibration; secondary blasting and related problems; surface miners; safety aspects.

Discontinuous/cyclic methods of excavation and transport; shovel dumper operation; electric shovel and hydraulic excavators; cycle time and productivity calculation; estimation of equipment fleet; dragline operation; side casting; calculation of reach; cycle time; productivity calculation; bucket capacity requirement; scrappers; bucket wheel excavator; (lateral block, half block and full block etc.,) productivity

calculation; continuous surface miner; (wide/full base, wide/full bench, block mining, stepped cut, empty travel back, turn back and continuous mining methods); conveyors; shiftable and high angle conveyors; in-pit crushing and strip-mining; opencast mining over developed coal seams; high-wall mining; safety aspect.

Application of concepts of Rock Mechanics for designing the methods of mining and strata control; Theories of ground movement and strata control; strength of stooks; shaft pillar; protection of surface structures; design and stability of structures in rock; rock mass rating; design of support and reinforcement for underground excavation consolidated and unconsolidated fills, rock bolts, cable bolts, subsidence, caving of rock mass; bumps monitoring of rock mass performance; mechanics of rock fragmentation; slope stability and dump stability; dump management; roof management.

Use and safe handling of explosives; blasting techniques and their relative efficiency, total cost concept.

(c) Mine Ventilation, Explosives, Fires and Inundation

Composition of mine atmosphere; Mine gases; generation, properties and effects; sampling and analysis of mine air; occurrence, properties, characteristics, detection and measurement of firedamp; methane drainage; flame safety lamp; methanometers and multi-gas detectors; gas chromatograph; methane layering; monitoring of different gases; telemonitoring; coal bed methane/coal mine methane.

Flame safety lamps and their design; use of maintenance; testing of safety lamps; lamp house and organization.

Heat and humidity :- Sources of heat in mines; geothermal gradient; effects of heat and humidity; heat transfer in bord and pillar and longwall workings; methods of calculation of heat flow and temperature rise; heat load due to various machines; air cooling and conditioning.

Air flow in mines:- Laws of air flow; resistance of airways; resistance and splitting problems; equivalent orifice; flow control devices; permissible air velocities.

Natural ventilation :- Seasonal variations; calculation of natural ventilation pressure.

Mechanical ventilation :- Mechanical ventilators; characteristics and selection, testing and output control; fans in series and parallel; reversal of air flow; fan drift, diffuser and evasee; booster and auxiliary fans; standards of ventilation; ventilation calculation.

Ventilation planning :- Ventilation layout; determination of size of shafts and airways; estimation of air quantity requirements; ventilation network analysis; thermodynamic network analysis and computer application; estimation of pressure requirement; ventilation survey; recent development in mine ventilation, ventilation plans.

Airbone dust :- Generation, dispersion, measurement and control; suppression and treatment of coal dust; properties of stone dust; sampling and analysis of coal dust.

Mine fires:- Cause of mine fires, spontaneous combustion, mechanism and susceptibility indices (crossing and ignition point temperature); wet oxidation potential; factors affecting spontaneous combustion; detection and prevention; dealing with mine fires; sealing off fire-areas; build-up of extinctive atmosphere; pressure balancing; fire fighting organization; gas ratios and their limitations; modified gas ratios; reopening of sealed off fire areas; fires in quarries over developed pillars; coal stack and waste dump fires.

Mine explosions :- Inflammability of fire damp and coal dust; fire damp and coal dust explosions; cause and prevention; stone dust barrier; water barrier and other methods.

Explosion in quarries over developed pillars.

Water gas explosion.

Inundation :- Causes and prevention; precautions and techniques of approaching old water logged working; safety boring apparatus; pattern of hole; design and construction of water dams; water lodgements; monsoon preparations, water danger plan.

Recovery of mine after explosion, fires and inundation and investigation rescue and recovery in mines; rescue apparatus; organization of rescue work; emergency preparedness and response system; emergency organization.

Illumination :- Cap lamps, layout and organization of lamp rooms; standards of illumination; photometry and illumination survey.

(d) Mining Machinery and Electricity

Theory of Machines :- Machine design, different types of gears and drives, bearing, collars and joints, brakes and friction clutches, governors.

Heat engines, general outline of working principles of steam generators and auxiliary equipment, condensing plant, reciprocating steam engines, turbines, internal combustion engines, conduct of gas, oil and steam engine trial; mechanical efficiency of engines, measurement of indicated and brake horsepower.

Machine tools and workshop processes:-

Wire ropes :- Construction details, applications, mechanical properties, breaking load, factor of safety bending factor, capacity factor, snap length, critical depth inspection; examination and discarding criteria; rope capping and splicing.

Mine winders :- Types and applications components; shaft fitting; drums and sheaves; ropes and guides; drives and control systems; automatic contrivances; brakes; cage; skip; counter weight and suspension arrangement; duty cycle diagram; winder capacity and motor power calculations; equivalent mass of winder installation; safety devices; Installation; examination and testing of winding equipment, non destructive testing.

Underground machinery :- Coal drills; jumbo drills; roof bolters; quad bolters; UDM; shearers; ploughs; AFC; road headers; ding headers; continuous miners; shuttle cars; SDLs; LHDs.

Material handling equipment in mines; Types, construction and operation; safety devices; maintenance and calculations for rope haulages; locomotives (tractive effort, draw bar pull, ideal gradient), conveyors (belt, chain, cable belt, high angle, shiftable and pipe conveyor); aerial rope-ways, man riding systems; in-pit crushers, feeder breaker etc., mine cars, track super elevation; track fitting and safety appliances; self acting inclines; coal handling plants; rail wagon loading; plants; use of diesel equipments in underground coal mines, free steered vehicles.

Pumps :- Types, Characteristics, motor power, capacity and calculations, laying of water mains, dealing with acid water; slurry, drainage; lodgements, storage, designs and layout of dams, sumps, pumping problems.

Opencast machinery :- Constructions, function and operation of blast hole drills, rippers, scrapers, shovels; draglines, dumpers, road graders, dozers, wheel

loaders; bucket wheel excavators; spreaders; surface miners and their maintenance aspects.

Generation, transmission and utilization of power, steam, compressed air; safety aspects.

Preventive, periodical and total maintenance systems in mines.

Mine electrical engineering :- Generation, Transmission and distribution of electrical power in mines; radial and ring main distribution; substation arrangements; short transmission lines; cables; switch gears and protective devices; protective relays; circuit breakers; gate-end box; drill panel; field switch; transwitch; symmetrical fault and circuit breaker rating; mine signaling; power factor improvement; electrical drives and semiconductor controllers; selection of motors and starters; semiconductor devices; principles of operation of thyristor controlled variable speed electrical drives; electrical breaking; earthing; flameproof enclosures and intrinsic safety; use of high voltage operational equipment in mines.

(e) Mine Surveying

Linear measurement :- Instruments for measuring distance and ranging, units of measurement in surveying.

EDM :- Principles of measurements; types; correction and selection of instrument.

Angular measurement :- Prismatic compass; bearing of lines; local attraction; magnetic declination.

Theodolite :- Modern micro-optic theodolites; measurement of horizontal and vertical angles; theodolite traversing; traverse calculation; computation of coordinates; adjustment of traverse; temporary and permanent adjustment; Gyro thedolite; principle and determination of Gyro north; determination of true bearing by equal altitude method; tacheometry.

Levelling :- Levelling instruments; types of leveling; characteristics and uses of contours; methods of contouring; booking and reduction methods; shaft depth measurement; temporary and permanent adjustment of levels.

Controlled surveys :- Triangulation; trilateration; application of GPS and Total Station in mine surveying.

Field astronomy :- Astronomical terms; determination of true bearing by equal altitude method; Gyro theodolite; principle and determination of Gyro north. Astronomical triangle; conversion of time system and precise determination of azimuth by astronomical methods.

Correlation :- Methods of correlation surface and underground including Gyro-Laser combination.

Development surveys :- Surveys of flat, moderately and steeply inclined and vertical workings; control of direction and gradient in drifts and roadways traversing along steep working with or without auxiliary telescopes.

Theory of errors and adjustments: Causes and classification of errors; inclines of precision; laws of weight; propagation and adjustment of errors; adjustment of triangulation figures.

National grid : Map projection Cassini Lambert's polyconic and universal transfers Mercator; transformation of coordinates.

Area and volume calculation :- Different methods and their limitations; earth work and building estimation; laying out of rail curves, surface and underground.

Dip, and strike problems; outcrop problems; borehole surveying and calculations.

Types of plans and their preparation, care, storage and preservation; legislation concerning mine plans and sections; duties and responsibilities of surveyors.

Application of computers in mine surveying and preparation of plans.

APPENDIX – I
SYLLABUS FOR EXAMINATION FOR MINE SURVEYORS CERTIFICATES OF COMPETENCY
(Under Coal Mines Regulations, 1957)
FIRST PAPER

Linear measurement :- Instruments for measuring distance ranging, chain surveying; errors in chaining and plotting; optical square.

EDM :- Principles of measurements; types; correction and selection of instrument.

Angular measurement :- Prismatic compass; bearing of lines; local attraction; magnetic declination.

Plan Table Surveying; methods contouring using plane table and micro-optic alidade.

Miners' dials and other compass instruments; dialing; loose and fast needle surveying.

Theodolite :- Modern micro-optic theodolites; measurement of horizontal and vertical angles; theodolite traversing; traverse calculation; computation of coordinates; adjustment of traverse; temporary and permanent adjustment.

Levelling :- Levelling instrument types of leveling; booking and reduction methods; temporary and permanent adjustment of levels; geometrical, trigonometric and physical leveling; characteristics and uses of contours; methods of contouring; traverse; co-ordinates and leveling problems.

Tachometry:- Controlled surveys :- Triangulation; trilateration; application of GPS and Total Station in mine surveying.

Use, care, testing, and adjustments of instruments.

SECOND PAPER

Field astronomy :- Astronomical terms; determination of true bearing by equal altitude method; Gyro theodolite; principle and determination of Gyro north, astronomical triangle; conversion of time systems and precise determination of azimuth by astronomical methods.

National grid : Map projection Cassini Lambert's polyconic and universal transfers Mercator; transformation of coordinates, vertical projections; mine models.

Geodesy :- Geod, spheroid and ellipsoid, geocentric, geodetic and astronomical coordinates, orthometric and dynamic heights.

Photogrammetry :- Introduction; scale of a vertical photograph; photographs versus maps; application of photogrammetry and remote sensing in mining.

Correlation :- Method of correlation surface and underground including Gyro-Laser combination.

Theory of errors and adjustments: Causes and classification of errors; inclines of precision; laws of weight propagation and adjustment of errors; adjustment of triangulation figures.

Surveying of flat, moderately and steeply inclined and vertical workings; control of direction and gradient in drifts and roadways; traversing along steep working with or without auxiliary telescopes.

Area and volume calculation; different methods and their limitations; earth work and building estimation; laying out of rail curves on surface and underground; measurement of depths of incline roadways and shafts; determination of azimuth latitude and longitude.

Borehole surveying and calculations; dip, strike, outcrop and fault problems.

Types of plans their preparation, care, storage and preservation; legislation concerning mine plans and sections; duties and responsibilities of surveyors.

Geological map reading.

Application of computers in mine surveying and preparation of mine plan;. 3D laser profiling of surfaces and bench walls.

APPENDIX – I
SYLLABUS FOR EXAMINATION FOR MINE OVERMAN'S CERTIFICATES OF COMPETENCY
(Under Coal Mines Regulations, 1957)

(a) General Safety and Legislation

Duties and responsibilities of workmen, competent persons and officials (excluding managers, assistant managers); discipline amongst workers and control of staff.

Provisions of the Coal Mines Regulations, 1957, relating to mine working; explosives and shortfiring; haulage; ventilation; precautions against danger from fire, dust, gas and water and of other provisions and Rules, the enforcement of and compliance with which is the responsibility of overmen.

Writing of reports required to be made by overman under the regulations.

Dangerous occurrences in mines and dealing with the same; accidents, their causes and preventions; accident reports; not disturbing the place of accident.

Mine rescue; physiological effect of mine gases; rescue equipment and First Aid.

Sanitation and health; miners' diseases, their symptoms and preventions.

(b) Methods of Working.

Nature of occurrence of coal seams; geological disturbances and their effects on working conditions; dangers and precautionary measures while approaching geological disturbances areas.

The purpose and utility of boreholes in mines; sinking; safety devices; temporary and permanent supports in sinking and working shafts; examination of shafts and outlets.

Opencast methods of mining; mechanized and manual methods; deep hole drilling and blasting; shovel and dumpers; dragline; bucket wheel excavators; surface miner; benching; maintenance of haul roads; precautions; while extracting developed pillars by opencast method and other safety precautions; methods of reclamation; dump management; high wall mining.

General principles of board and pillar and longwall method; multi-section workings; method of depillaring under different conditions; mechanized pillar

extraction; precautions to be taken while working near/beneath waterlogged areas; roof convergence and convergence measuring devices etc., stone drifting.

Elements of roof control :- Rock Mass Rating (RMR) of roof strata; mechanism of rock bolting; support of roadways; face supports and their types, setting, testing and withdrawal; systematic support rules; packing and stowing; protection of surface structures; working beneath statutorily restricted areas and surface structures.

Safe handling and use of explosives; in coal and stone in gassy and non-gassy mines; simultaneous short firing; blasting in fire areas in opencast mines; safety precautions.

Inspection of workings; inspection and maintenance of haulage and travelling roadways; man riding system and return airways; gates and fences.

Reading of statutory plans.

(c) Ventilation and Precautions against Explosives: Fires and Inundation

Natural and mechanical ventilation ; ventilation of headings and sinking shafts; siting of auxiliary and booster fans; distribution, measurement and control of air in mines; estimation of air quantity requirements; methods of coursing of air; anemometer; hygrometer; maintenance of ventilation appliances.

Pollution of air; irruption/occurrence of gases in mines; properties of gases; detection and measurement of firedamp and noxious gases; sampling of air; determination of environmental condition; standards of ventilation.

Design and construction of flame and electric safety lamps; their use, examination and maintenance.

Suppression and treatment of coal dust; suitability of stone dust; sampling and analysis of mine dust.

Elementary knowledge of causes and prevention of firedamp and coal dust explosion, limits of inflammability of fire-damp.

Prevention, detection and control of spontaneous heating/fire; sealing off fire areas; fire stopping and their examination; precautions against outbreak of surface fires; fire fighting on surface and belowground.

Inspection of old workings.

Sources of danger from surface and underground water, precaution, to prevent inundation and irruption of water; precautionary measures while approaching abandoned and water logged areas, boring machines for exploratory work; water dams; water danger plan.

Recovery of mines after explosions fires and inundation; precautionary measures during re-opening and dewatering of mines.

(d) Elements of Mining Machinery.

Safety aspects and safe use of different kinds of machinery used in underground and opencast mines e.g. blast hole drills, rippers; scrappers; shovels; draglines; dumpers; road graders; dozers; wheel loaders; bucket wheel excavators; spreaders; surface continuous miners; brakes (including service and parking brakes); use of steam and internal combustion engines in mines.

Application of electricity in mines; safety precautions.

Winding equipments; ropes and guides; signaling and decking arrangements; safety devices; examination of winding equipments and shaft fittings.

Haulage and transport; types of haulage; rope haulage and locomotives; self-acting inclines; haulages; roads in underground and opencast working; rails and

tracks; their maintenance and inspection; tubs; signaling; safety devices; codes of practices; traffic rules; unsafe practices; derailments.

Different types of pumps; principles and use of siphons; drainage and water lodgments.

Code of practice for transport, installation, use and shifting of underground and opencast machinery.

Belt conveyors and safety appliances.

No. DGMS (Approval/Circular No./ 01 Dhanbad, Dated – 18/02/2009

To,

Owner/Agent/Manager of All Coal and Metal Mines.

Sub:- Approval of Dust Suppression/Prevention System in Drilling machines used in mines.

In continuation to DGMS (Approval)/Circular No.5 dated 25.11.2008, regarding approval of Dust Suppression/Prevention System in Drilling machines used in mines a Notification No. 16(38)79-Genl/6095 Dated 25.11.2008 published in the Gazette of India Part – II Section 3 (i) on 13.12.2008 vide GSR 215 is reproduced below for strict compliance.

"In exercise of the powers conferred on me under Regulation 123(6)(b)(ii) of Coal Mines Regulation, 1957 and Regulation 124(6)(b)(ii) of Metalliferous Mines Regulation 1961, I, M.M. Sharma, Chief Inspector of Mines also designated as Director General of Mines Safety hereby declare 31st December 2008 as date from which following item will not be used in Coal Mines and Metalliferous Mines unless the same has been approved by me by a general or special order in writing.

1. Dust Suppression/Prevention device in drilling and boring equipment.

No. DGMS/S&T/Tech.Cir. (Approval No./ 02 Dhanbad, Dated – 18th June 2009

To,

All the Owner/Agent/Manager & Manufacturer

Sub:- Standard Composition and Properties required for Cement Capsules to be used as grouting material in Roof Bolting in Mines.

1.0 BACKGROUND

In early years in mining, timber was the primary material being used as supports of the underground excavations in belowground mines. In those days, good quality treated timbers were available in sample and was also being imported from Burma (Now Myanmar). Increased exploitation of forest resources and rampant deforestation resulted in scarcity of timbers even for house hold uses. Steel then came into market

as substitute and is invariably used in the industry including domestic uses. Cement is equally important material to be used along with the steel in industries and infrastructure fields.

Roof Bolts are now being used as common support in underground mines all over the world along with the cement or resin grout to reinforce the strata and provide adequate support in the excavation. Since past ten to fifteen years, cement grouted roof bolts have almost replaced the timber supports in coal mines in India.

It is highly desired that the roof bolts once installed should immediately start taking load of the roof strata and prevent dilation so as to eliminate chances of roof fall. Quick Setting Cement Grout was the only option to provide required support resistance. Various composition were tried by adding quick setting chemicals and other re-agents in the cement composition. It was then possible to gain pull out load of about 3 Tonnes within 30 minuters and 5 Tonnes within 2 hours of installation. The Resin Grouts were also available for use in mines but it was cost prohibitive and uneconomical for Indian conditions during nineties. With the advancement of technologies and faster rates of extraction, resin capsule is now being invariably used and are now economically viable in case of mass production.

However, the use of cement capsules would continue for medium and small scale productions. A number of technical circulars have been issued from this Directorate regarding load requirements, installation, testing and use of roof bolts from time to time.

Technical Circular No.6 of 1996, Circular No. 3 and 6 of 1993 are highly elaborative and exclusive on the subject. In spite of the best effort put in both from the mine operators as well as from this Directorate, the results are not upto the expected level.

2.0 NECESSITY

It would be pertinent to mention here the trends of fatal accidents in coal mines especially due to fall of roof and sides. The accidents data analyzed for the past fifteen to twenty years during which the full column grouted roof bolts along with cement capsules were being used, have revealed that :-

(i) 38 to 40% of the fatal in coal mines are caused due to fall of roof and sides;
(ii) 57 to 60% of the total below ground accidents are caused due to fall of roof and sides; and
(iii) 58 to 60% of the roof fall accidents occur within 10 m of the face i.e. within the Freshly Exposed Roof Area.

A number of accidents due to fall of roof have occurred within 2 to 4 hours of exposure of the roof where cement grouted roof bolts were used that failed and fell along with the failing roof of thickness varying from 0.25 to 1.2m. In many cases during the course of inspection and enquiry, it has been found that the roof bolts which were expected to take 3 Tonnes of anchorage load after 30 minutes of installation were pulled out within 1.6 to 2.4 Tonnes. The roof Bolts which were

expected to take 5 Tonnes of load after 2 hours of installation were pulled down in less than 3 Tonnes.

The above observations necessitated in-depth studies on this subject and to have a better system to check and monitor the quality of grout as well as the roof bolts being used in the mines. With this objective in view, it was decided in this Directorate to bring the support materials and the Steel supports under the purview of approval and testing before being used in the mines. A notification vides G.S.R. 160, dated 14th August, 2008 and DGMS Technical Circular No. (S&T)3/703 dated 14th August, 2008 were issued in this regard.

3.0 APPROVAL & TESTING

The applicants were granted approval for field Trials and Testing based on their Tests and Performance Reports submitted along with their applications. During the period of such approval, samples were collected from the Manufactures Units and tested at the Central Institute of Mining and Fuel Research (CIMFR), Dhanbad. On receipt of the Test Reports from CIMFR, it was observed that many of the Cement Capsules manufactured by various manufactures could not pass the bare minimum requirements and had failed. The detailed information on the Tests Data of few samples is tabulated below:-

Test Data No. 1

(a) Physico- Mecanical Properties

Sl. No	Parameters	Acceptable Limit	Result	Conclusion
1	Average Soaking Time	3.0 Minutes (Maximum)	2.55 Minutes	Passed
2	Initial Setting Time	3.0 Minutes (Maximum)	3.30 Minutes	Failed
3	Final Setting Time	15.0 Minutes (Maximum)	6.00 Minutes	Passed
4	Compressive Strength gained after • 30 Minutes • 2 Hrs • 24 Hrs • 7 Days • 21 Days • 28 Days	Minimum Compressive Strength in MPa 4.5 9.0 16.0 16.0 16.0 16.0	 3.00 4.90 4.65 4.60	Failed

5	Anchorage Strength after • 30 Minutes • 2 Hrs • 24 Hrs	Minimum in Tonnes 3.0 5.0 8.0	 3.2 3.5	 Failed

(b) Chemical Properties

Sl. No	Parameters	Acceptable Limit	Result	Conclusion
1	Thicksotropic/Viscosity	Minimum – 35,000 Cps & Maximum – 50,000 Cps	4300 cps	Passed
2	Chloride Free Test	No Chloride	Chloride Present	Failed
3	Shrinkage Test @ 27 ± 20^0 C & 65% Humidity • 24 Hrs • 7 Days • 35 Days	 Maximum 0.01% Maximum 0.01% Maximum 0.01%	 0.015%	 Failed
4	Chemical Constituents • Loss on Ignition • Calcium Oxide (CaO) • Magnesium Oxide (MgO) • Ferrous Oxide (Fe_2O_3) • Alumina (Al_2O_3) • Silicon Dia Oxide (SiO_2)	 Maximum – 2% Maximum – 35% Maximum – 2% Maximum – 5% 10 to 25% Maximum 20%	 4.0 23.32 1.41 2.00 3.40 24.00	 Failed

Test Data No. 2

(a) Physico- Mecanical Properties

Sl. No	Parameters	Acceptable Limit	Result	Conclusion
1	Average Soaking Time	3.0 Minutes (Maximum)	2.34Minutes	Passed
2	Initial Setting Time	3.0 Minutes (Maximum)	3.35 Minutes	Failed
3	Final Setting Time	15.0 Minutes (Maximum)	5.10 Minutes	Passed
4	Compressive Strength gained after • 30 Minutes • 2 Hrs • 24 Hrs • 7 Days • 21 Days	Minimum Compressive Strength in MPa 4.5 9.0 16.0 16.0 16.0	 4.69 4.08 5.80 7.45	 Failed

	• 28 Days	16.0		
5	Anchorage Strength after • 30 Minutes • 2 Hrs • 28 Hrs	Minimum in Tonnes 3.0 5.0 8.0	 2.8 3.5	 Failed

(b) Chemical Properties

Sl. No	Parameters	Acceptable Limit	Result	Conclusion
1	Thicksotropic/Viscosity	Minimum – 35,000 cps & Maximum – 50,000 cps	39000 cps	Passed
2	Chloride Free Test	No Chloride	Chloride Present	Failed
3	Shrinkage Test @ 27 ± 20^0 C & 65% Humidity • 24 Hrs • 7 Days • 35 Days	 Maximum 0.01% Maximum 0.01% Maximum 0.01%	 No Shrinkage	 Failed
4	Chemical Constituents • Loss on Ignition • Calcium Oxide (CaO) • Magnesium Oxide (MgO) • Ferrous Oxide (Fe_2O_3) • Alumina (Al_2O_3) • Silicon Dia Oxide (SiO_2)	 Maximum – 2% Maximum – 35% Maximum – 2% Maximum – 5% 10 to 25% Maximum 20%	 7.0 23.77 5.19 2.46 2.34 32.00	 Failed

Note :- It was also observed that the compressive strength had reduced by 25% when the casted cement blocks were immersed in water before subjecting compressive strength testing. Thus the above composition was found unsuitable for wet or watery strata conditions.

On examination of the above information, it was found that the bare minimum anchorage load of 3 and 5 Tonnes required after 30 minutes and 2 hours could not be achieved. Even the required compressive strength of 16 MPa could not be achieved after 24 hours and also after 7 days. In addition, the composition had failed in other tests. Therefore the approvals granted to such manufactured were withdrawn.

4.0 STANDARD PARAMETERS & CHEMICAL COMPOITION

Based on the above observations, it was decided in this Directorate to have detailed discussions on this matter with the scientist from CIMFR who are dealing with this subject and also from the Expert on Strata Control and Rock Mechanics from Indian School of Mines University. After detailed deliberation on various issues and

parameters required for the Cement Capsule, it was decided that the following parameters shall be essentially required for the Cement Capsules to be used in mines as a Grouting materials.

Sr. No.	Parameters	Acceptable Limits
1	Average of soaking time (Minutes)	3.0 (max)
2	Initial setting time (Minutes)	3.0 (max)
3	Final setting time (Minutes)	15.0 (max)
4	Compressive Strength Gain after- • 30 Minutes • 2 Hrs • 24 Hrs • 7 Days • 21 Days • 28 Days	**Minimum in MPa** 4.5 9.0 16.0 16.0 16.0 16.0
5	Anchorage Strength after • 30 Minutes • 2 Hrs • 28 Hrs	(Minimum in Tonnes) 3.0 but test will be conducted till complete failure 5.0 but test will be conducted till complete failure 12.0 but test will be conducted till complete failure

(b) Chemical Properties of Cement Capsules

Sr. No.	Chemical Test	Acceptable Limits
1	***Chloride Free*** Chloride free cement capsule composition is essential because, presence of chloride will exchange the rusting rate of MS steel bolt grout with cement capsules. This may lead to release the MS steel bolt from the grouting material.	**NIL**
2	***Viscosity/Thyrotrophic Nature of Wetted Cement Capsules*** Proper Viscosity and flow of wetted cement capsule is necessary for proper grouting of the bolts. Viscosity of wetted cement capsule should not be to less to flow out of the hole and should not be too high to difficult to insert the MS steel bolt. The optimum viscosity of cement capsules will be in the range of 35,000 to 50,000 cps.	**35,000 to 50,000 cps.**
3	***Shrinkage Test (IS:4031 (Part 10) 1988*** Shrinkage of the grouted cement capsules should not be more than 0.01% at 27 ± 2^0 C and 65% humidity	**Less than 0.01%**

	upto 35 days. If shrinkage is allowed than bolt with grouted material will release the surface of the hole and will fall out from the hole.	
4	***Calcium Oxide*** Calcium Oxide exchange the cementing properties of the grouting material and present in the quick set cement and other cements used in the manufacturing of the cement capsules. The optimum quantity of CaO is essential for getting the proper setting time as well as strength in the grouting material. Optimum quantity of CaO is 35%. Below the optimum it will affect the setting time and strength of the grouting material and above the optimum percentage brittle nature will develop in the grouting material. Cracks develops in the grouted material will release the bolt and become unsafe to mine environment.	**30 to 35%**
5.	***Alumina*** Alumina plays an important and crucial role in the initial setting, final setting and getting proper strength in the cement capsules. The quantity of alumina in the cement capsule is depends upon the quantity of high alumina cement added in the composition. Generally high alumina cement contain 35-45% alumina content and for manufacturing cement capsule of good quality and for manufacturing cement capsule of good quality about 30% high alumina cement should be added in the composition. Therefore, percentage of alumina percentage should not be less than 10% to get proper setting time as well as strength and shelf life of the grouting material. It was observed that above 25% alumina content in the cement capsules, the brittle nature of the grouted material is increased and cracks were developed in the material due to exothermic reacition.	**10 $_0$ 15%**
6.	***Iron Oxide*** Proper quantity of iron oxide in the cement capsules is required for getting proper performance and it should be not more than 5%. Above the optimum percentage iron oxide will enhance the brittle nature of the grouting material.	**5% (Max.)**
7.	***Magnesium Oxide*** Optimum quantity of magnesium will give the better result but increase in percentage will decrease the setting time but increase the brittle nature of the material which may lead to decrease in the strength of the material. MgO content.	**2% (Max.)**
8.	***Loss on Ignition*** Organic and other combustible material should not be more than 2% of the total mass. It is observed that	

	water reducers, plasticizes and organic grouting material will enhance the physico- mechanical properties of the grouting material but above 2% it will give adverse effect on the grouting materials.	**2% (Max.)**
9.	***Silica Content*** Silica plays an important role in the cement capsules and will provide encapsulation properties as well as enhance the strength and other physico- mechanical properties of the grouted material. With high alumina strength silica gives proper binding and compressive strength to the MS bolt. Proper quantity of silica is required for getting good quality of cement capsule composition and it should not be more than 20% of the total mass. The silica should be clay free.	**15 to 20%**
10.	***Plaster of Paris*** It was observed that present manufactures are using plaster of Paris in place of high alumina cement. Due to POP physico- mechanical properties is below the acceptable limits and giving very poor results. Therefore, it is advised to instruct the cement capsule manufactures not to add POP and manufacture POP free cement capsules.	**NIL**

4.1 TEST FACILITIES AT MANUFACTURER'S UNIT

In order to ensure and maintain the quality of cement capsule manufactured at the manufacturing units, it shall be required to have the following apparatus & testing facilities:

Sr. No.	Name of Apparatus/Equipment	Quantity (Nos)	Capacity
1.	Viscometer	One	10,00,000 cps.
2.	Humidifier	One	Humidity 90% Temp. 5-50 ^{O}C
3.	Anchorage Testing Machine	One	50 Tonnes
4.	Universal Compressive testing machine	One	50 Tonnes
5.	Vicat Apparatus	One	As per IS;5513:1996
6.	Muffle Furnace	One	1000^{0}C
7.	pH meter	One	0-14
8	Flow Table	One (With different cones)	As per requirement
9.	Stop Watch	Two	
10	Hot Air Oven	One	Ambient – 250^{0}C
11	Heater	Three	500^{0}C
12	Magnetic Stirrer	One	100^{0}C
13	Glassware	As per	-

		requirement	
14	Chemicals	As per requirement	-

4.2 TEST FACILITIES AT USER'S END

Similarly, the user shall also have the responsibility to ensure that the required quality of the cement capsules is provided in the mine for use. Thus the cement capsules shall also be tested before being allowed to be used in mines and for this purpose, at least the following apparatus/equipment shall be maintained at the user's end:

Sl. No.	Name of Apparatus/Equipment	Quantity (Nos)	Capacity
1.	Viscometer	One	10,00,000 cps.
2	Anchorage Testing Machine	One	50 Tonnes
3	Universal Compressive testing machine	One	50 Tonnes
4	pH meter	One	0-14

5.0 SAMPLING & TESTING

In order to check the composition and required parameters during manufacture, it shall be required that the random sampling shall be collected at least 1 sample containing adequate number/quantity of cement capsules for every 10,000 pieces of cement capsule in a batch and shall be subjected to the required set of tests as prescribed at para-4.0 above and the data shall be kept recorded in a bound paged book kept for the purposes which shall be signed by the persons carrying out the test and shall also be counter-signed by the quality control officer posted at the manufacturing unit (s).

5.1 The user shall also carry out similar sampling and testing as per the apparatus/instrument kept there at their end before using, for every batch of cement capsules and keep the records in a bound paged book kept for the purpose.

In case the cement capsules fall to pass the required tests at the user end, that lot of the manufactures shall not be used and intimation thereof shall be sent to this Directorate and also to the manufacturer.

Manufacturers and the Users including the Test Houses, who are engaged for testing such material, are therefore requested to ensure the above mentioned Standard and Parameters before supplying and using at the mine.

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