



सत्यमेव जयते

भारत सरकार

Government of India

श्रम एवं रोजगार मंत्रालय

Ministry of Labour & Employment

खान सुरक्षा महानिदेशालय

Directorate General of Mines Safety

धनबाद / Dhanbad - 826 001.



No. DGMS (Tech.) (S&T) Circular no. 05

Dhanbad, Dated 2th April 2016

To

All Owners/ Agents/ Managers of coal and metalliferous mines

Integrated approach for development of Safety Management Plan for coal and metalliferous mines

The ninth and tenth Conference on Safety in mines recommended adopting Risk Assessment as a tool for development of appropriate health & safety management systems in Indian mines. The eleventh Conference further recommended that the managements of every mining company should adopt the process of safety management system and commit itself for proper formulation and implementation of the same in totality.

Drawing inputs from inferences drawn from several workshops on "Risk Assessment" in Indian mines conducted by DGMS, a document on "Safety Management System – A guideline for implementation" was prepared and circulated as DGMS(Tech)(S&T) Circular No. 13 of 2002. Another guideline in this regard titled "Safety Management System- Provision for auditing and review" was issued by DGMS as DGMS (Tech)(S&T) Circular No. 02 of 2011.

Successful implementation of Safety Management System in Mines would warrant sorting out perception issues among all stakeholders, and the success may depend on among others, adoption of an integrated approach.

The matter has been discussed with various stakeholders of coal and metalliferous industry in the recent past. During interaction some of the implementation issues inhibiting its outreach were flagged. They are: lack of penetration of the concept at grass root level; confusion about implementation strategy, and; lack of involvement of frontline mining personnel in developing the document.

In view of the above, an integrated implementation strategy, as a sequel to the DGMS (Tech)(S&T) Circular No. 13 of 2002 (without appendixes), has been developed and enclosed as Annexure for compliance.

You are requested to take necessary steps for development of Safety Management System in the mines under your control with the help of above guidelines. The Mine Manager shall submit a copy of the Safety Management Plan to the Regional Inspector of Mines for acceptance.


(Rahul Guha) 2.11.16

Director General of Mines Safety

Encl. - Annexure (1-10) & sample worksheet (S1-S9)

1. Hazard identification & Risk Management

1.1 Formation of team: Mine Manager/Operations-in-charge as team leader, members may be suitably chosen from the following for carrying out hazard identification and risk management in mines.

- a) Safety officer
- b) Engineer (Mines)
- c) Workmen's Inspector(s)
- d) In-charge, mine production
- e) In-charge, mechanical section
- f) In-charge, electrical section
- g) In-charge, civil wing
- h) In-charge, occupational health & hygiene
- i) In-charge, mine surveying
- j) Supervisor's and/or workmen selected from activities mentioned at (d), (e), (f), (g), (h) and (i), including machine operators, fitters and electricians
- k) Rapportier(s)

For advice and technical guidance regulators, eminent mining scientists, experts from academic & research institutions and representatives from manufacturers may be invited to participate in risk assessment sessions.

Team may co-opt members if considered necessary.

1.2 Tools of Risk Management: (a) Following documents may be arranged for consideration of team.

- Minutes of safety committee meeting
- Workmen's Inspectors report
- Contraventions pointed out by regulators and action taken report
- Safety officer's inspection report
- Report (s) submitted by Internal Safety Organization, if any
- Previous risk assessment document, if any
- Report (s) on accidents and near misses

A study of the above reports may help in identifying key safety and health issues in different areas of mining operations.

(b) A computer system which supports Microsoft Office 2007 or its latest version and printer.

1.3 Getting Started – Hazard Identification

Inquest into mining accidents and incidents often reveal systems failure. The system comprises of man, machines, and materials that are designated to perform a spelled task in a specified environment. All constituent are interconnected to perform the task. A failure of any constituent can cause a failure of the system. A risk assessment exercise needs to take into account all the constituents and any associated hazards and human factors.

Every mine, operational, discontinued or abandoned has a threat perception based on systems analysis through an established procedure or by assessment of safety professionals. A control system generic or otherwise may be in place to maintain the workplace risk within acceptable level.

Looking out for hazards is to identify the (i) probable location where there is a likelihood of release of unwanted energy or object(s) (ii) medium through which the unwanted energy or object(s) may travel and, (iii) the miner may be in danger of being contacted by the unwanted energy or object(s).

While identifying hazards in a classified sector, number of workers who may be exposed need to be taken in account to ascertain possible degree of consequences in the event of a mishap in following manner:

Table 1

Serial No	Percentage of work persons employed	Impact assessment of exposure
1.	>40	Maximum
2.	20-40	High
3.	10-20	Medium
4.	5-10	Low
5.	<5	Very Low

An example of identification of hazards and categorization thereof have been detailed in Table 2

**Table 2: Initial Hazard Identification
(28 Hazards Initially Identified)**

Sl. No.	Description of Hazard	Percentage of workers exposed	Cons.	Prob.	Exposure	total
1	Existing Mine Fire-potential for explosion					
2	Roof fall (Strata control)					
3	Mine Gases					
4	Waterlogged workings					
5	Survey-incorrect mine plan					
6	Improper survey instruments					
7	Lack of skilled persons/using unskilled persons in specified jobs					
8	Inundation from surface source					
9	Surface blasting and vibrations					
10	Winding (Shaft)					
11	Boilers					
12	Blasting					
13	Spontaneous Combustion					
14	Unauthorized entry to mine workings					
15	Lack of illumination					
16	Haulage & transport failure					
17	Side fall					
18	Moving machinery (including illegal man-riding on SDL etc.)					
19	Electricity					
20	Drivages not to plan					
21	Carbon monoxide poisoning					
22	Material handling					
23	Respirable dust					
24	Noise					
25	Inadequate Ventilation					
26	Slippery roadway					
27	Improper traveling roadway					

Table 3: Hazard Identification

**HAZARDS IDENTIFIED AS HIGH RISK
(Risk > 200)
Requiring immediate attention**

Sl. No.	Description of Hazard	Percentage of workers exposed	Cons.	Prob.	Exposure	Total
1	Existing Mine Fire-potential for explosion					
2	Roof fall (Strata control)					
3	Mine Gases					
4	Waterlogged workings					
5	Survey- incorrect mine plan					
6	Improper survey instruments					
7	Lack of skilled persons/using unskilled persons in specified jobs					
8	Inundation from surface source					

Hazard Identification (Continued)

**OTHER HAZARDS IDENTIFIED AS RISKS
REQUIRING MANAGEMENT ACTION
(Risk <200 and >20)**

Sl. No.	Description of Hazard	Percentage of workers exposed	Cons.	Prob.	Exposure	Total
1	Surface blasting and vibrations					
2	Winding (Shaft)					
3	Boilers					
4	Blasting					
5	Spontaneous Combustion					
6	Unauthorised entry to mine workings					
7	Lack of illumination					
8	Haulage & transport failure					
9	side fall					
10	Moving machinery (including illegal man-riding on SDL etc.)					
11	Electricity					
12	Drivages not to plan					
13	Carbon monoxide poisoning					

Hazard Identification (Continued)

OTHER HAZARDS IDENTIFIED AS LOW
RISK BUT TO BE REVIEWED
(Risk <20)

Sl. No.	Description of Hazard	Percentage of workers exposed	Cons.	Prob.	Exposure	Total
1	Material handling					
2	Respirable dust					
3	Noise					
4	Inadequate Ventilation					
5	slippery roadway					
6	Improper travelling roadway					

Table 4: Summarized Hazard Identification

11 Major Hazard Categories Identified

- (01) Mine Fires
- (02) Inundation
- (03) Machinery
- (04) Strata Control
- (05) Mine Gases
- (06) Electricity
- (07) Blasting & Use of Explosives
- (08) haulage & Transportation
- (09) Spontaneous Combustion
- (10) Occupational Health
- (11) Emergency Response

Table 5: Categorization of Identified Risks

No.	Major Hazard	Sub Category of Hazard
1	Mines Fires	: Existing Mine Fire :Lack of skilled persons/using unskilled persons : Surface blasting and vibrations :Unauthorized entry to mine workings :Coal dust - explosion :Inadequate Ventilation
2	Inundation	:Waterlogged workings :Survey- incorrect mine plan :Improper survey instruments :Lack of skilled persons/using unskilled persons :Inundation from surface source : Surface blasting and vibrations :Drivages not to plan
3	Machinery	:Lack of skilled persons/using unskilled persons :Winding (Shaft) :Boilers :Lack of illumination :Moving machinery (including illegal man-riding on SDL etc.)

Categorization of Identified Risks (continued)

No.	Major hazard	Sub Category of Hazard
4	Strata Control	:Roof fall (Strata control) : Side fall :Lack of skilled persons/using unskilled persons :Improper survey instruments :Surface blasting and vibrations :Lack of illumination
5	Mine Gases	:Mine Gases :Fire damp :Coal dust - explosion :Inadequate Ventilation
6	Electricity	:Electricity :Lack of skilled persons/using unskilled persons

Categorization of Identified Risks (continued)

No.	Major Hazard	Sub Category of Hazard
7	Blasting & Use of Explosives	:Blasting :Lack of skilled persons/using unskilled :Coal dust - explosion :Drivages not to plan
8	Haulage & Transportation	:Lack of illumination :Haulage & transport failure :Moving machinery (including illegal man-riding on SDL etc.) :Material handling
9	Spontaneous Combustion	:Spontaneous Combustion
10	Occupational Health	:Respirable dust :Noise :Lack of illumination
11	Emergency Response	:Improper travelling roadway

1.4 Development of worksheet for Risk assessment, control and audit

The template of worksheet for risk assessment, control and audit exercise may include, among others, document number, title, name of the mine, company, date conducted, location, etc. followed by the list of assessment team members and facilitators, as below:

RA WORKSHEET-	UG-MVH/RA/
Risk Assessment - Mine Ventilation/inundation/..... in underground coal/metal mines	
Name of the Mine: AAA Name of the Company: BBB	
Date Conducted: CCC	
Location: DDD	

Assessment Team (May include)	
Name	Designation
EEE	Mines Manager (MM)
FFF	Colliery Engineer (CE)
GGG	Safety Officer (SO)
HHH	Ventilation Officer (VO)
III	Assistant Manager (AM)
JJJ	Mechanical Engineer/Asst. Mechanical Engineer (ME/AME)
KKK	Electrical Engineer/Asst. Electrical Engineer (EE/AEE)
LLL	Medical Officer (MO)
MMM	Civil Engineer (CER)
NNN	Survey Officer/Surveyor (SUO/SUR)
OOO	Workman Inspector (Mining) (WIM)
PPP	Workman Inspector (Mechanical) (WIME)
QQQ	Workman Inspector (Electrical) (WIE)
RRR	Overman/ Mining Sirdar (OM/MS)
SSS	Foreman (Mechanical/Electrical)
TTT	Electrical /Mechanical Supervisor (ES/MS)
UUU	Radiologist
VVV	Workmen/ Safety Committee Members
Add	Add

Facilitators (May include)	
Name	Designation
WWW	Deputy Director/Director, DGMS
XXX	Chief/ Deputy Chief/Member, ISO
YYY	Area Safety Officer
ZZZ	Area Medical Officer
EEFF	Area Engineer (Electrical)
GGHH	Area Engineer (Mechanical)
IIJJ	Scientist, Research Institutions
KKLL	Subject Expert, Educational Institutions
Add	Add

1.5 Risk Assessment

A sample of risk assessment exercise conducted in respect of mine inundation has been furnished as Table 6.

1.6 Risk control

While developing Risk Control plans for identified hazards, due weight age may be ascribed to the number of workers present at the place of work to assign priority.

A sample Risk Control plan pertaining to mine inundation assigning the responsibility and time limits for completing the designated action (s) has been furnished at Table 7.

1.7 Auditing

Auditing of Risk management scheme is to be conducted by trained auditors. Incomplete activities which have been assigned Immediate Action (IA) tag by auditors depending upon hazard perception, severity and exposure, need to be reported to agent(s) and owner(s) by the manager. A system may be devised to send daily/weekly/fortnightly/monthly progress report as the case may be, by the manager to agent(s) and owner(s), till the activities with IA tag are satisfactorily completed.

A sample audit sheet indicating gaps in achieving risk control within specified time frame in respect of mine inundation has been furnished at Table 8.

1.8 Emergency exercise

International best practices suggest that the exercise to be systematic in nature and consistent with the concept of mutual assistance from other mines. It should be able to make direct reference to the risks at the mine. The purview of the exercise should be inclusive of external agencies such as DGMS, police, media and senior company officials. The conduct of exercise is subject to risk assessment principles to ensure the exercises do not introduce new safety risks to persons at a mine and have an audit and evaluation process.

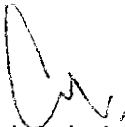
1.8 Concluding Remarks

The developed Safety Management Plan in respect of a coal or metal mine may contain, among others the following:

- ✓ Mine Safety & Health Policy with a plan for its implementation;

- ✓ Organizational structure and resources for implementation of (a) mine safety & health policy and (b) safety management plan
- ✓ Risk Assessment data sheets;
- ✓ Hazard Control Plans for identified hazards;
- ✓ A list of Hazard Control Plans with yellow Flag (YF);
- ✓ Audit sheets for Hazard identification and Control Plans;
- ✓ A list of Hazard Control Plans with Immediate Action Flag (IAF);
- ✓ A list of developed Code of Practices (COP);
- ✓ A list of developed schedules, schemes and strategies
- ✓ A list of developed Standard Operating Procedures (SOP);
- ✓ A list of developed processes, protocols and systems
- ✓ Emergency Management Plan including trigger action response plans (TARP) and emergency initiation protocol (EIP);
- ✓ Emergency exercise logs and recommendations;
- ✓ Maintenance schedules of electrical equipments used in the mine;
- ✓ Maintenance schedules of mechanical equipments used in the mine;
- ✓ Safety manuals of electrical & mechanical equipments used in the mine; and
- ✓ A list of trainings/refresher trainings conducted.

The list of Hazard Control Plans with yellow and Immediate Action Flag need to be accorded due priority by Agent & Owner. A schedule for implementing the recommendations made during the conduct of emergency exercise need to be drawn by the mine manager in consultation with agent/owner in a time bound manner. A copy of correspondences made with concerned authorities and agencies regarding mitigation of identified hazards in the mine may be kept for records.


(Rahul Guha) 2-4-16

Director General of Mines Safety

Table: 6**Sample worksheet (Risk Assessment: Inundation in underground coal mines)**

Name of the Mine: AAA Name of the Company: BBB

Date Conducted: CCC

Location: DDD

Assessment Team	
Name	Designation
EEE	Mines Manager (MM)
FFF	Safety Officer (SO)
GGG	Ventilation Officer (VO)
HHH	Assistant Manager (AM)
JJJ	Survey Officer/ Surveyor (SURO/SUR)
KKK	Workman Inspector (Mining) (WMI)
LLL	Overman/ Mining Sirdar (OM/MS)
MMM	Workmen/ Safety Committee Members
Add	Add

Facilitators (may include)	
Name	Designation
PPP	Deputy Director/Director, DGMS
QQQ	Chief/ Deputy Chief/Member, ISO
RRR	Area Safety Officer
SSS	Scientist, Research Institutions
TTT	Subject Expert, Educational Institutions
Add	Add

Hazard identification as regards to inundation in multiple seam underground workings with caving/ stowing.

Abbreviations: **HAZ:** Hazard; **CONS:** Consequence; **EXPS:** Exposure; **PROB:** Probability.

HAZ NO	HAZARD	MECHANISMS	CALCULATED RISK				COMMENTS
			CONS	EXPS	PROB	RISK RATING	
1	2	3	4	5	6	7	8
UNH -1	Lack of knowledge on procedures.	Documents available are sketchy and not adequate.	05	10	10	500	Workshop on development of Safety Management Plan need to be conducted.
UNH -2	Lack of knowledge on procedures.	Workers and supervisors not trained to follow procedures.	05	10	10	500	Specialised refresher training required.
UNH -3	Lack of knowledge on procedures.	Surveillance to implement procedures.	05	10	10	500	Specialised process(es) to be devised.

HAZ NO	HAZARD	MECHANISMS	CALCULATED RISK				COMMENTS
			CONS	EXPS	PROB	RISK RATING	
1	2	3	4	5	6	7	8
UNH -4	Sudden inrush of water in underground mine workings from surface.	Failure of coal pillars due to existence of fire in underground, allowing connection through subsidence cracks with shallow surface rain water accumulation and flooding of underground.	05	10	07	350	
UNH -5	Sudden inrush of water in underground mine workings from surface.	Failure of embankment constructed at river bank due to heavy rain, and entry of water from surface through old workings and subsidence area to underground mine workings.	05	10	07	350	
UNH -6	Sudden inrush of water from workings of one seam to another seam in underground.	Failure of dam constructed in the connection drift between workings of two seams, causing sudden inrush of water from workings of one seam to another seam in underground.	05	10	07	350	
UNH -7	Sudden inrush of water in underground mine workings from surface.	Flooding of river due to heavy rain and water finding its way to underground workings through subsided area over goaf or mine entries.	05	05	07	175	
UNH -8	Sudden inrush of water from workings of same seam or from one seam to another seam in underground.	Barriers against water logged old workings failing under hydrostatic pressure causing inrush of water in underground workings.	05	10	07	150	
UNH -9	Sudden inrush of water from workings of same seam or from one seam to another seam in underground	Sudden inrush of water from old water logged workings of same seam or from one seam to another seam in underground due to accidental connection.	05	05	02	50	
UNH -10	Sudden inrush of water in underground mine workings from surface.	Failure of river bank/embankment due to damage from mine subsidence.	05	10	01	50	
UNH -11	Sudden inrush of water in underground workings from adjacent strata.	Pillar failure or creep allows goaf formation to connect with subsurface water body/aquifer.	05	10	01	50	
UNH -12	Sudden inrush of water in underground workings from adjacent strata.	Roof fall in development workings taps overlying aquifer or subsurface water accumulation.	05	1.5	02	15	
UNH -13	Sudden inrush of water in underground workings from	Mine workings intersect geological structure providing water flow channel.	01	02	01	02	

HAZ NO	HAZARD	MECHANISMS	CALCULATED RISK				COMMENTS
			CONS	EXPS	PROB	RISK RATING	
1	2	3	4	5	6	7	8
	adjacent strata.						
UNH -14	Sudden inrush of water in underground workings from adjacent strata.	Existing mine workings intersect open boreholes.	0.1	2.0	07	1.4	
UNH -15	Sudden inrush of water trapping mine workers in underground.	Proper emergency response protocol including effective communication from surface to underground not in place.	05	02	10	100	Workshop on Emergency Preparedness & Response systems needs to be conducted.
UNH -16	Sudden inrush of water trapping mine workers in underground.	Lack of exposure and practice of workers and supervisors to follow emergency response protocol.	05	02	10	100	

Table: 7**Sample worksheet (Control Plan: Inundation in underground coal mines)**

Name of the Mine: AAA Name of the Company: BBB

Date Conducted: CCC

Location: DDD

Assessment Team	
Name	Designation
EEE	Mines Manager (MM)
FFF	Safety Officer (SO)
GGG	Ventilation Officer (VO)
HHH	Assistant Manager (AM)
JJJ	Survey Officer/ Surveyor (SURO/SUR)
KKK	Workman Inspector (Mining) (WMI)
LLL	Overman/ Mining Sirdar (OM/MS)
MMM	Workmen/ Safety Committee Members
Add	Add

Facilitators (may include)	
Name	Designation
PPP	Deputy Director/Director, DGMS
QQQ	Chief/ Deputy Chief/Member, ISO
RRR	Area Safety Officer
SSS	Scientist, Research Institutions
TTT	Subject Expert, Educational Institutions
Add	Add

Inundation Hazard Control Plan in multiple seam underground workings with caving/stowing.

Abbreviations: **RSP**-Relevant Statutory Provisions; **DGC**- DGMS Circulars; **MG**-Management Guidelines; **ERCI**- Existing Risk Control Index; **Res**- Responsibility; **Med**- Medium; **Reg**- Regulation of draft Coal Mines Regulations'2015; **Rul (T)**: Rule of Mine Vocational Training Rules' 1966; **SOP**- Standard Operating Procedure. **YF**- Yellow Flag.

Mechanism	Control	RSP/DGC/ MG	Procedure	ERCI	Res	Comments
Failure of coal pillars due to existence of fire in underground allowing connection through subsidence cracks with shallow	1. Ensure efficient measures of controlling underground fire by trained personnel under competent supervision.	Reg. 137(6) & 139(5) & MG.	1. Devise a mechanism for fighting of underground fire in consultation with experts of an academic institute and implement the same under managerial supervision.	Low	MM & Agent.	1. To be put in place within one month (YF).

Mechanism	Control	RSP/DGC/ MG	Procedure	ERCI	Res	Comments
surface rain water accumulation and flooding of underground workings.	2. Ensure drainage of rain water from large surface depression and filling up of the same.	Reg.150(1).	2. Constitute a team for drainage of water from surface depression and filling up of the same, as and when required under competent supervision.	Med	AM & MM.	2. To be put in place within fifteen days (YF).
	3. Training of mine personnel.	Rul(T)-09; DGC- Legis 4/1975	3. Conduct specialized training of mine personnel on danger of inundation.	Med	MM & Agent.	3. To be completed within one month's time.
Failure of embankment constructed at river bank due to heavy rain and entry of water from surface through old workings and subsidence area to underground mine workings.	1. Assess the strength and stability of embankment constructed at river bank.	Reg150(9) & (10); DGC2/1978.	1. Conduct a study for assessing strength and stability of embankment in consultation with experts of a research institute. Implement suggestions for strengthening embankment, if any, under competent supervision.	Low	Civil Engineer, AM & MM.	1. System to be put in place within two months time before onset of monsoon (YF).
	2. A system of sounding warning during heavy rain and withdrawal of persons from underground, if considered necessary, to be in place.	Reg150(5); DGC2/1978.	2. Devise a code of practice for warning during heavy rain, and evacuation of work persons from underground, if warranted.	Med	AM & MM.	2. System to be put in place within one month's time (YF).
Failure of dam constructed in the connection drift between workings of two seams, causing sudden inrush of water from workings of one seam to another seam in underground.	Assess stability of dam from available records. If need be, explore the possibility of strengthening the existing dam or construction of a new dam.	Reg 153.	1. Conduct stability assessment exercise in consultation with experts of a research/academic institute.	Low	Civil Engineer, AM & MM.	1. Complete exercise within one month time (YF).
			2. Formulate a work process for strengthening of existing dam or construction of a new dam and execute the same by trained personnel under competent supervision.	Low	Civil Engineer, AM & MM.	2. The work process to be formulated and executed within three months time (YF).
Flooding of river due to heavy rains and water finding its way to underground workings through goaf and /or mine entries.	Access rainfall data of last thirty years in the area and corresponding High Flood Level (HFL) to formulate strategy for preventing entry of water in underground workings through goaf and/or mine entries.	Reg150(2).	Formulate strategy for preventing entry of water in the underground workings through goaf and/or mine entries and initiate action for implementing the same.	Low	Mine Planning Engineer, AM & MM.	System to be put in place within one month (YF).

Mechanism	Control	RSP/DGC/ MG	Procedure	ERCI	Res	Comments
Barriers against water logged old workings failing under hydrostatic pressure causing inrush of water in underground workings.	Ensure maintenance of barrier as prescribed under mining laws.	Reg151(3).	Formulate and implement a work scheme to ensure maintenance of barrier as prescribed under mining laws.	Med	AM & MM.	System to be put in place within one month (YF).
Sudden inrush of water from old water logged workings of same seam or from one seam to another seam in underground due to accidental connection.	Ensure leaving prescribed barrier as per the provisions of the statute from old water logged workings while advancing mine galleries in underground.	Reg151(3).	Conduct periodic mine survey and check survey to ensure maintenance of barrier as prescribed under mining laws.	Med	SURO/ SUR, AM & MM.	Work to be completed within one month (YF).

Table: 8

Sample worksheet (Audit of Hazard Identification and Control Plan: Inundation in underground coal mines)

Name of the Mine: AAA Name of the Company: BBB

Date Conducted: CCC

Location: DDD

Assessment Team	
Name	Designation
EEE	Mines Manager (MM)
FFF	Safety Officer (SO)
GGG	Ventilation Officer (VO)
HHH	Assistant Manager (AM)
JJJ	Survey Officer/ Surveyor (SURO/SUR)
KKK	Workman Inspector (Mining) (WMI)
LLL	Overman/ Mining Sirdar (OM/MS)
MMM	Workmen/ Safety Committee Members
Add	Add

Facilitators (may include)	
Name	Designation
PPP	Deputy Director/Director, DGMS
QQQ	Chief/ Deputy Chief/Member, ISO
RRR	Area Safety Officer
SSS	Scientist, Research Institutions
TTT	Subject Expert, Educational Institutions

Audit of Hazard identification and Control Plan as regards to inundation in multiple seam underground workings with caving/stowing.

Abbreviations: IAF: Immediate Action Flag; SOP: Standard Operating Procedure.

Hazard identification Plan:
(General comments)

Hazard Control Plan:

Mechanism	Control	Procedure	Action Taken	Observations and Comments
Failure of coal pillars due to existence of fire in underground allowing connection through subsidence cracks with shallow	1. Ensure efficient measures of controlling underground fire by trained personnel under competent supervision.	1. Devise a mechanism for fighting of underground fire in consultation with experts of an academic institute and implement the same under managerial supervision.	1. A preliminary discussion to devise a mechanism of fighting underground fire has been held with experts of an academic institute.	1. Immediate action to be initiated by the MM & Agent to put the mechanism in place (IAF).

Mechanism	Control	Procedure	Action Taken	Observations and Comments
surface rain water accumulation and flooding of underground workings.	2. Ensure drainage of rain water from large surface depression and filling up of the same. 3. Specialized training on combating underground mine fire.	2. Constitute a team for drainage of water from surface depression and filling up of the same, as and when required under competent supervision. 3. Conduct specialized training of mine personnel on combating underground mine fire.	2. A team has been constituted with senior most Asst. Manager as team leader. 3. Training is yet to be conducted.	2. Monitoring in this regard to be done in ongoing manner by MM and Agent. 3. MM & Agent to facilitate conduct of training within one month.
Failure of embankment constructed at river bank due to heavy rain and entry of water from surface through old workings and subsidence area to underground mine workings.	1. Assess the strength and stability of embankment constructed at river bank. 2. A system of sounding warning during heavy rain and withdrawal of persons from underground if considered necessary, to be in place.	1. Conduct a study for assessing strength and stability of embankment in consultation with experts of a research institute. Implement suggestions for strengthening embankment, if any, under competent supervision. 2. Devise a code of practice for warning during heavy rain, and evacuation of work persons from underground, if warranted.	1. Discussion is in progress to engage a research institute for conducting the study. 2. A code of practice has been devised and being implemented.	1. Immediate action to be initiated by the MM & Agent for facilitating conduct of study and implementation of recommendations (IAF). 2. Ensure implementation of the code of practice by AM & MM.
Failure of dam constructed in the connection drift between workings of two seams, causing sudden inrush of water from workings of one seam to another seam in underground.	Assess stability of dam from available records. If need be, explore the possibility of strengthening the existing dam or construction of a new dam.	a) Conduct stability assessment exercise in consultation with experts of a research/academic institute. b) Formulate a work process for strengthening of existing dam or construction of a new dam, if the need be and execute the same by trained personnel under competent supervision.	a) The stability assessment exercise has been conducted by the experts of an academic institute, who recommended strengthening of the existing dam. b) The work process has been formulated. As recommended, action for strengthening of existing dam has been initiated.	MM & Agent to complete the action for strengthening of existing dam within one month's time (IAF).

Mechanism	Control	Procedure	Action Taken	Observations and Comments
Flooding of river due to heavy rains and water finding its way to underground workings through goaf and/or mine entries.	Access rainfall data of last thirty years in the area and corresponding High Flood Level (HFL) to formulate strategy for preventing entry of water in underground workings through goaf and/or mine entries.	Formulate strategy for preventing entry of Water in the underground workings through goaf and/or mine entries and initiate action for implementing the same.	A scheme has been devised and proposed to be put in use shortly.	AM & MM to expedite implementation of the scheme (IAF).
Barriers against water logged old workings failing under hydrostatic pressure causing inrush of water in underground workings.	Ensure maintenance of barrier as prescribed under mining laws.	Formulate and implement a work scheme to ensure maintenance of barrier as prescribed under mining laws.	A work scheme has been formulated and in the process of being implemented.	AM & MM to keep a continuous watch over implementation of the system.
Sudden inrush of water from old water logged workings of same seam or from one seam to another seam in underground due to accidental connection.	Ensure leaving prescribed barrier as per the provisions of the statute from old water logged workings while advancing mine galleries in underground.	Conduct periodic mine survey and check survey to ensure maintenance of barrier as prescribed under mining laws.	A system of conducting barrier survey has been formulated and in the process of being implemented.	AM & MM to keep a continuous watch over implementation of the system.