

I.L.O. Codes of Practice

**Prevention of Accidents
Due to Fires
Underground in Coal Mines**

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INTRODUCTION

For many years the International Labour Office has been engaged in extensive activities with the object of promoting higher standards of safety and health in coal mines. A *Model Code of Safety Regulations for Underground Work in Coal Mines for the Guidance of Governments and of the Coal-Mining Industry*¹ was adopted by a tripartite technical conference in 1949; meetings of experts on the prevention and suppression of dust in mining, tunnelling and quarrying were held in 1952 and 1955; a substantial study in two volumes, entitled *Safety in Coal Mines*², was published in 1953 and 1955; and the subject was discussed in 1956 at the Sixth Session of the Coal Mines Committee. In spite of all the national and international efforts made, however, the accident rates in coal mines remain very high and the world is from time to time shocked by disasters such as the one that occurred on 8 August 1956 in the Charleroi coal-field of Belgium, where 262 miners lost their lives underground as the result of an outbreak of fire in the Bois du Cazier mine at Marcinelle.

The Marcinelle disaster undoubtedly intensified interest in all countries in the prevention of coal-mining accidents and has in particular given urgency to the problem of preventing major disasters which may cost the lives of large numbers of miners. One sign of this intensification of interest can be seen in the convening by the High Authority of the European Coal and Steel Community of a conference on safety in coal mines, which opened in September 1956 and concluded its work in February 1957.

¹ Geneva, I.L.O., 1950.

² Studies and Reports, New Series, No. 33 (2 vols).

The disaster also stimulated the Office to accelerate its plans for further action designed to help reduce accident risks in coal mines. The experience acquired in the compilation of the Model Code and *Safety in Coal Mines* showed that the subject was vast and at the same time exceedingly complex. It therefore seemed appropriate that the Office should deal successively with selected branches of the subject rather than endeavour to cover it all again at one and the same time.

After consulting a number of experts the Office came to the conclusion that the next branches of the subject to be selected for treatment should be mine fires and electricity underground. Research undertaken by the Office had shown that fire and electricity have been factors in a substantial proportion of coal-mine disasters in recent years.

In November 1956 the Director-General proposed to the Governing Body of the International Labour Office that a number of suitably qualified experts should meet to make recommendations concerning the prevention of accidents in coal mines caused by fire and electricity underground. He suggested that the agenda of the meeting should be as follows:

(1) Mine Fires (risks, technical preventive measures, fire-protection organisation at the mine, fire-fighting equipment, procedure in case of fire, rescue organisation, etc.).

(2) Electricity Underground (risks, authorisation procedure for the use of electrical equipment, technical preventive measures applicable to all mines, additional technical preventive measures required in fiery and dusty mines, electrical safety organisation at the mine, supervision, operation and maintenance of electrical equipment, etc.).

The Governing Body accepted the Director-General's proposals and at its session of May-June 1957 fixed the date and composition of the meeting.

The meeting was held at the International Labour Office, Geneva, from 2 to 18 October 1957 and was attended by the following experts:

- Mr. E. BERTIEAUX (France), former Director of the Central Rescue Station of the Nord and Pas-de-Calais Coalfields, Douai.
- Mr. C. BIHL (France), Director, Lorraine Coalfield, Merlebach.
- Mr. W. BLUME (Federal Republic of Germany), Miners' Trade Union, Bochum.
- Mr. J. BLUNT (United Kingdom), Divisional Safety Engineer, North-Eastern Division, National Coal Board, Doncaster.
- Mr. I. V. BOBROV (U.S.S.R.), Director of the Makeevka Research Institute for Safety in Coal Mining, Makeevka.
- Mr. J. COWAN (United Kingdom), Principal Electrical Inspector of Mines, Safety and Health Division, Ministry of Power, London.
- Mr. E. DEMELENNE (Belgium), Divisional Director, Mining Administration, Liège.
- Mr. A. DENIS (Belgium), General Manager, S.A. des Charbonnages de Monceau-Fontaine, Roux.
- Mr. C. R. DROUARD (France), Principal Inspector of Mines, Paris.
- Mr. E. W. FELEGY (United States), Sub-District Supervisor, U.S. Bureau of Mines, San Francisco.
- Mr. S. FLOWERS (Australia), Senior District Mining Engineer of the Joint Coal Board, Newcastle.
- Mr. G. GECK (Federal Republic of Germany), Ministerial Counsellor, Mining Section, Federal Ministry of Economic Affairs, Bonn.
- Mr. P. GÉRARD (Belgium), Divisional Director, Mining Administration, Hasselt.
- Mr. T. L. GIBBS (Union of South Africa), Deputy Government Mining Engineer, Department of Mines, Johannesburg.
- Mr. C. GRARD (France), Chief Underground Engineer, Nord and Pas-de-Calais Coalfields, Lens.

- Mr. S. S. GREWAL (India), Chief Inspector of Mines in India, Department of Mines, Dhanbad.
- Mr. F. HÜLSBERG (Federal Republic of Germany), Chief of the Electrotechnical Department of the Mining Testing Station, Dortmund-Derne.
- Mr. E. JONES (United Kingdom), Vice-President, National Union of Mineworkers, Wrexham.
- Mr. D. J. KNUTTEL (Netherlands), Inspector of Mines, State Inspectorate of Mines, Heerlen.
- Mr. S. KURACHI (Japan), Assistant Chief of the Coal Mine Section of the Mine Safety Bureau, Ministry of International Trade and Industry, Tokyo.
- Mr. M. MARRA (Italy), Superintending Mining Engineer, Directorate General of Mines, Ministry of Industry and Trade, Rome.
- Mr. S. OSAGAWA (Japan), Manager, Mine Safety Inspection Division, Yamano Coal Mine, Mitsui Mining Co. Ltd., Fukuoka-Ken.
- Mr. A. S. STUGAREV (U.S.S.R.), Chairman of the Committee of the U.S.S.R. Council of Ministers for Safety Inspection in Industry and Mines, Moscow.
- Mr. W. H. TOMLINSON (United States), Training Administration Officer, United States Bureau of Mines, Pittsburgh.
- Mr. J. WRONSKI (Poland), Chief of Service, Institute of Mining Safety, Mikolow.
- Mr. Bertieaux was accompanied by Mr. M. AUSSEIL, Chief Engineer of the Aquitaine Coalfield, Decazeville; Mr. Bihl was accompanied by Mr. CŒUILLET, Principal Engineer, Charbonnages de France, Paris, and by Mr. BRONNER, Engineer attached to the General Management of the Lorraine Coalfield, Merlebach; Mr. Jones was accompanied by Mr. L. JAMES, Head of the Safety Department, National Union of Mineworkers, Ebbw Vale; Mr. Knuttel was accompanied by Mr. P. DE ZEE, Head of the Safety Depart-

ment of the State Mines, Heerlen, and by Mr. H. L. OMERS, Chief Mining Engineer, Orange Nassau Mine, Chief of the Electrical Service, Heerlen; and Mr. Wronski was accompanied by Mr. H. BYSTRON, Chief of the Mine Ventilation Service, Institute of Mining Safety, Mikolow.

The Governing Body had also authorised the Director-General to invite the High Authority of the European Coal and Steel Community, the Miners' International Federation and the International Electrotechnical Commission to be represented at the meeting by observers. The High Authority was represented by Mr. M. GERLACHE, Division of Labour Problems, Luxembourg; the Miners' International Federation by Mr. N. DETHIER, General Secretary, Federation of Belgian Mineworkers' Unions, Brussels; and the International Electrotechnical Commission by Mr. J. COWAN, one of the experts taking part in the meeting.

Mr. Drouard was unanimously elected Chairman of the Meeting.

As a possible basis for discussion the Office had prepared two preliminary draft codes of practice, the first relating to the prevention of accidents caused by fires and the second to the prevention of accidents caused by electricity underground in coal mines.

These preliminary drafts had been compiled from the *Model Code of Safety Regulations for Underground Work in Coal Mines*, from the recommendations of the Coal-Mining Safety Conference of the European Coal and Steel Community held at Luxembourg in 1956-57 and from numerous national regulations, standards, instructions, codes of practice, manuals, research reports, safety pamphlets, etc. The Office had endeavoured to confine the provisions of the drafts to those that were either already widely applied in coal-mining countries or appeared to merit consideration by an international meeting of experts.

The meeting set up two groups, one for fires and the other for electricity.

The Fires Group was composed of Messrs. Bertieaux, Blume, Blunt, Ferguson, Flowers, Geck, Gérard, Gard, Grewal, Jones, Knuttel, Kurachi, Marra, Stugarev and Tomlinson, accompanied by Messrs. Ausseil, Bystron, James and de Zee. Mr. Gérard was elected Chairman of the group, and Mr. Flowers Reporter. A drafting committee was appointed consisting of Messrs. Blunt, Flowers, Gérard and Gard.

The preliminary draft relating to the prevention of accidents due to fires underground in coal mines was accepted as the basis of discussion.

The group considered that a complete code of practice on the prevention of accidents due to fires underground in coal mines should deal with questions of firedamp, coal dust and shotfiring. It preferred not to endeavour to draft complete sets of provisions on these subjects because the time was too short and the scope of the subjects was difficult to define. The group was of the opinion that it would be useful to discuss at a future date the risks inherent in shotfiring with special reference to the risks arising from firedamp and coal dust.

The Office had included specific provisions in the preliminary draft concerning permanent rescue organisation and rescue operations, since fires, including those resulting from explosions, doubtless furnish the majority of the occasions on which rescue operations are required. The group agreed with this view, and accordingly the code includes a section on rescue.

The text of the code of practice as revised by the group was discussed, amended, and finally adopted by the full meeting. The present text is the one finally adopted with slight editorial amendments, introduced by the Office.

Many provisions of the code of practice prepared by the experts differ in some degree from the corresponding provisions of the *Model Code of Safety Regulations for Underground Work in Coal Mines*. The experts were informed that the Governing Body of the I.L.O. had recently

recognised the desirability of amending those provisions of the Model Code that are no longer in keeping with the best practices of the present time. They considered that revision was necessary in so far as concerns fires, and that their recommendations would provide a very useful basis for the experts who would subsequently be entrusted with the revision of the Model Code.

The meeting endeavoured to keep constantly in mind that coal-mining techniques are steadily progressing and that, in drafting the provisions of a code of practice, allowance has to be made both for existing conditions and for conditions that, it may be expected or hoped, will exist in the future. Consequently, the meeting endeavoured to frame the code of practice in such a way as to ensure a maximum of protection under existing conditions without at the same time hindering technical progress.

The experts endorsed the view of the Office that the code of practice, although couched in the language of sets of rules, has no binding force whatsoever but is merely a body of practical advice for the guidance of all those who, in any capacity, have some responsibility for safety in coal mines. The value of the code lies in the fact that it is the work of a group of experts and embodies the knowledge and experience of many countries.

The experts realised that not all the provisions can be applied as they stand to all the coal mines of every country; some of them will require adaptation to national or local conditions. They further realised that it would not be practicable to apply some of the provisions to existing mines and equipment, but they were satisfied that, subject to the necessary adaptation, the code as a whole might usefully serve as a guide to those planning new mines and designing new equipment and also for the alteration or extension of existing mines or equipment.

The experts hope that this code of practice will be of value to all countries, and particularly to those which are

being rapidly industrialised but have not yet had sufficient experience in the prevention of accidents due to fires underground in coal mines.

They consequently recommended that the code should be widely distributed in an appropriate form in coal-producing countries so as to reach all those who have a part to play in combating mining accidents. They are convinced that, if the code is everywhere followed as a guide, the toll taken by accidents due to fires in the coal mines of the world can be appreciably reduced.

PART I

PROVISIONS APPLICABLE TO ALL COAL MINES

DEFINITIONS

1. In this Code of Practice—
 - (a) the term “competent authority” means a minister, government department or other public authority having power to issue or approve regulations or instructions in respect of the prevention of accidents due to fires underground in coal mines, or an authority entrusted with the enforcement of such regulations or instructions ;
 - (b) the term “manager” means a duly qualified and appointed person legally responsible for the technical direction of the mine, whether he is the mine operator or a person appointed by him.

SECTION I. GENERAL OPERATING PRECAUTIONS

General Provisions

2. (1) In the planning, installation and operation of mines all practicable precautions should be taken for the prevention, detection, limitation and fighting of fires.

(2) When planning mines provision should be made for dividing the workings into independent ventilation districts with due regard to fire risks.

3. (1) Every mine that is not a small mine exempted by the competent authority should have an adequate organ-

isation of persons for the prevention, detection and fighting of fires.

(2) Neighbouring small mines so exempted should combine to have such an organisation.

4. Shotfiring should be carried on in compliance with the relevant requirements of the *Model Code of Safety Regulations for Underground Work in Coal Mines*¹ or requirements at least equally strict.

5. Precautions against firedamp should comply with the relevant requirements of the *Model Code of Safety Regulations for Underground Work in Coal Mines* or requirements at least equally strict.

6. Precautions against coal dust should comply with—

(a) the relevant requirements of the *Model Code of Safety Regulations for Underground Work in Coal Mines* or requirements at least equally strict ;

(b) the relevant recommendations of the Meeting of Experts of the International Labour Office on the Prevention and Suppression of Dust in Mining, Tunnelling and Quarrying²; and

(c) the relevant requirements of this code of practice.

7. Measures for the prevention of fires of electrical origin should comply with the provisions of the code of practice entitled *Prevention of Accidents Due to Electricity Underground in Coal Mines*.³

¹ I.L.O. : *Model Code of Safety Regulations for Underground Work in Coal Mines for the Guidance of Governments and Industry* (Geneva, I.L.O., 1950).

² *Occupational Safety and Health* (Geneva, I.L.O.), Vol. III, No. 1, Jan-Mar. 1953, pp. 8-12 and Vol. VI, No. 2, Apr.-June 1956, pp. 75-80.

³ Geneva, I.L.O., 1959.

8. In gassy mines, except in downcast shafts, such alloys of light metals and paints based on these metals as are considered dangerous by the competent authority should not be used.

9. In buildings or structures covering the shafts and other outlets or in the immediate vicinity of the shafts or outlets, adequate precautions should be taken to eliminate risks of fire.

10. Fireproof closing devices which can be operated quickly and effectively should be provided at a suitable place in all downcast shafts or other intake surface openings.

11. (1) Whenever, in the event of a surface fire, flames, gases or smoke could reach a downcast shaft or other intake surface opening a decision should be taken concerning—

- (a) the evacuation of the personnel from underground workings; and
- (b) the closing of the devices referred to in paragraph 10 or the continuation of the ventilation.

(2) Every mine should have rules specifying the persons empowered to take this decision with due regard to the risk inherent in gassy mines.

12. The closing devices should be maintained in good working order and tested as often as necessary.

13. (1) It should be prohibited to smoke underground or to bring into the underground workings pipes, tobacco for smoking, cigarette papers, matches and cigarette lighters or similar devices, and the necessary examinations should be made for this purpose.

(2) In mines in which safety lamps are not compulsory the competent authority may grant exemptions from this requirement.

(3) No person who refuses to allow himself to be searched should enter a mine.

14. (1) Respirators affording adequate protection against carbon monoxide (self-rescue apparatus) should be provided in sufficient quantities at mines in which the competent authority considers this necessary.

(2) Frequently repeated instructions should give information to the underground personnel on the use of the respirators and the care that should be taken of them.

(3) In particular, these instructions should specify the limitations in the use and efficacy of the respirators.

(4) Competent persons appointed by the manager should be responsible for the examination and proper maintenance of the respirators.

Incombustible or Fire-Resistant Construction

Shafts and Other Outlets.

15. The buildings or structures covering the shafts or other outlets, or in the immediate vicinity of the shafts or outlets, and also the headframes, should be built of incombustible material.

16. (1) In all shafts and other outlets, priority being given to downcast shafts and other intake surface openings, flammable auxiliary equipment should be replaced by fire-resistant material as soon as practicable.

(2) In new shafts and other outlets, and in shafts and other outlets that are reconstructed, only incombustible material should be used; provided that guides, retaining beams for tail ropes and sump timbers may be of hard wood.

(3) Grease used for lubricating guides should have a high ignition temperature.

17. Underground shaft landings, roads and other places, and doors in them, connected to shafts should be of incombustible construction, or be effectively treated or

covered so as to be incombustible, up to a distance of at least 80 yds. (75 m) from the shaft.

18. (1) In mines in which the provisions of paragraphs 16 and 17 are not complied with, near all landings of downcast shafts incombustible fire doors should be installed that can be shut tight, and open against the air current.

(2) Even when the fire doors are closed there should be a travelling means of communication between all mine workings shut off from the downcast shaft on the one hand and the surface on the other.

(3) Whenever flames, gases or smoke could pass such doors a decision should be taken concerning the closing of the doors.

(4) Mine rules should specify the persons empowered to order the said doors to be closed with due regard to the risk inherent in gassy mines.

(5) The fire doors should be maintained in good working order and tested as often as necessary.

Staples.

19. (1) Staples should as far as practicable be built in special by-passes or passages of a sufficient length.

(2) New staples should as far as practicable be constructed of incombustible material.

Roads.

20. Main intake airways should be constructed and repaired with permanent supports and lagging of incombustible material.

21. (1) Crossings and junctions of main airways should be of incombustible material.

(2) Stoppings between main intake and main return airways should be of incombustible material.

22. Roads on both sides of main ventilation doors should be made incombustible over an adequate distance.

23. (1) Main ventilation doors and their frames should be made of incombustible or fire-resistant material.

(2) The frames should be set in masonry, concrete or similar material.

24. (1) The use of brattice cloth should be avoided as far as practicable.

(2) If brattice cloth is used it should be fire-resistant unless it is constantly maintained in a wet condition.

Rooms.

25. (1) Haulage rooms, engine rooms, workshops and rooms connected to them should be constructed of incombustible material.

(2) Rooms in which there is combustible or flammable material should be—

- (a) of incombustible construction ;
- (b) so situated that, in case of fire, smoke and other harmful gases are evacuated directly into the return airway without spreading through the travelling roads and faces ;
- (c) provided with fireproof doors on the intake air side that can be hermetically closed ; and
- (d) either under constant supervision during working hours or provided with automatic fire detectors or alarms and with fire-extinguishing devices.

Combustible and Flammable Materials

26. With the exception of the quantities required for the day, stocks of combustible or flammable materials should not be kept in the buildings covering the shafts or other outlets.

27. No piping for flammable liquids should be installed in shafts or other outlets.

28. Flammable liquids with a flash point not exceeding 130°F (55°C), as determined in accordance with a recognised standard, combustible liquefied and compressed gases, acetylene and calcium carbide should not be stored underground.

29. (1) The quantities of other combustible and flammable materials stored underground should be restricted to the indispensable minimum.

(2) As a general rule, combustible and flammable materials should be—

- (a) transported underground in closed metal receptacles ;
and
- (b) stored underground in masonry recesses with metal doors or in fireproof rooms.

30. (1) In underground engine rooms lubricants and flammable cleaning materials should be kept in closed metal containers or in masonry recesses with metal doors.

(2) Greasy, oily and other flammable waste should be placed in closed metal receptacles and regularly removed from the mine.

31. Installations with fluid transmission should as far as practicable only be operated with non-flammable fluids.

32. Flammable materials such as grease or coal dust should not be allowed to accumulate to a dangerous extent anywhere in or about the mine, and, in particular, on head-frames and shaft buildings, in shafts and in underground places where mechanical equipment or electrical equipment is installed.

33. (1) Combustible material should be avoided as far as practicable for stowing, or in the building of packs, and should not be left in the goaf in greater quantities than absolutely necessary.

(2) Washery or screening refuse, if used for stowing, should be so mixed with incombustible material or power-stowed that when in place it does not constitute a fire risk.

Machinery and Plant

General Provisions.

34. Machinery of all kinds should be so constructed, installed, operated, maintained and supervised as to avoid any friction or defect liable to cause dangerous heating.

35. Oil-filled couplings should be provided with fusible plugs or other devices that will effectively prevent the oil from becoming dangerously overheated.

36. Installations should not be lubricated with oils having a low flash point.

37. Where necessary, installations should be—

- (a) installed so as to ensure the safe discharge of static electricity; and
- (b) frequently tested for static electricity.

Pressure Plant.

38. All apparatus containing or producing air, gas or steam at a pressure greater than atmospheric pressure should be so constructed, installed, used, maintained and supervised as to obviate any risk of fire.

39. No steam boiler or other steam generating plant should be installed underground unless it is of a type approved by the competent authority.

Coal-Cutting and Coal-Getting Machines.

40. At any face where the coal is dry, coal-cutting and coal-getting machines should be provided with effective water sprays.

Compressed-Air-Driven Equipment.

41. Equipment driven by compressed air, except hand-held portable equipment, should be provided with—

- (a) isolating valves that will prevent it from inadvertently starting up ;
- (b) exhaust baffles that will reduce the velocity of the exhaust air ; and
- (c) means of preventing the projection of oil over a large area.

42. Compressed-air valves should be of the wheel type.

43. Compressed-air valves should be closed when the equipment that they control is not in use.

44. Compressed-air equipment should be examined for overheating and other fire risks—

- (a) at frequent intervals during operation ; and
- (b) during idle periods.

45. (1) Compressed-air piping and hose should be installed and maintained so as to limit leaks to the technically practicable minimum.

(2) Any leakage in compressed-air piping and hose should be stopped as soon as practicable.

(3) Flanges should be of incombustible material.

(4) Where necessary, the accumulation of dangerous electrostatic charges on compressed-air piping and hose and all other compressed-air equipment should be prevented by adequate earthing.

(5) When compressed-air piping and hose are blown out, care should be taken to turn on the air slowly.

Internal-Combustion Engines.

46. The use of internal-combustion engines other than diesel engines should be prohibited underground.

Rope Haulage.

47. Rope haulage should be stopped if any tub, rope or load rubs against the roof, sides, supports or anything else in the road in such a way as to cause dangerous heating.

Winches (Brakes).

48. Winches (brakes) should have—

- (a) wide-rimmed pulleys; and
- (b) incombustible brake linings and sheave packings.

49. Adequate measures should be taken to prevent winches from overheating.

Methane Drainage Installations.

50. Methane drainage piping should be—

- (a) installed and maintained airtight;
- (b) maintained below atmospheric pressure;
- (c) inspected at frequent intervals as to airtightness; and
- (d) distinguished in a conspicuous manner from other piping.

51. Except in special cases permitted by the competent authority, methane drainage pipes should not be installed in downcast shafts or other intake surface openings.

52. (1) Extractors should not be installed underground.

(2) If an extractor is installed underground, the methane piping should discharge on the surface, except with the approval of the competent authority and subject to conditions approved by that authority.

53. Effective measures should be taken to prevent overheating of extractors.

54. Flame arresters should be installed on both sides of extractors on the surface.

55. Methane drainage installations on the surface should be provided with analysing apparatus to enable the methane content to be controlled.

56. The installation should stop automatically as soon as the methane content falls to 30 per cent.

Conveyor Haulage

General Provisions.

57. Conveyor installations should be so constructed, installed, operated, maintained and supervised as to avoid any friction or defect liable to cause dangerous heating.

58. Belts of belt conveyors should be of incombustible or fire-resistant material.

59. (1) The supports in belt-conveyor roads should be of incombustible material to an adequate distance from the driving head to be prescribed by the competent authority.

(2) If such incombustible supports are impracticable in belt-conveyor roads, the driving head should be protected by an automatic sprinkler installation unless an effective automatic anti-slip device is provided.

Installation.

60. Belt conveyors should be so installed that the distance of the conveyor from the roof, floor and sides of the road is large enough—

- (a) to enable the road to be cleared of fallen coal without danger; and
- (b) to enable all the mobile parts of the installation to be properly inspected.

61. In conveyor roads, belt-conveyor structures should be suspended or supported by incombustible appliances.

62. (1) In conveyor roads, belt-conveyor driving heads should be provided with devices that will stop the drive automatically if the belt breaks, jams or slips excessively.

(2) As far as practicable driving heads of belt conveyors in conveyor roads should be equipped with devices that stop the drive if dangerous heating develops in them.

63. Where conveyors are driven by compressed air, the compressed-air pipe should be provided with reliable wheel-type stop valves and a readily disconnectable flexible connection.

64. Precautions should where necessary be taken to prevent the accumulation of dangerous electrostatic charges on belt conveyors, for example by the use of anti-static belts and of lubricating oils of low resistance.

Supervision.

65. Belt conveyors should be patrolled—

- (a) at frequent intervals while they are working ;
- (b) at regular intervals for at least two hours after they have stopped, or after any disturbance in operation ;
and
- (c) at suitable times on idle days.

Maintenance.

66. Belts should be maintained at the correct alignment and tension.

67. (1) Conveyor mechanisms should be kept well lubricated.

(2) Only lubricants with a high ignition temperature should be used for the mechanisms.

68. (1) Rollers should be kept clear of coal dust and of all obstructions that might cause friction.

(2) The mobility of rollers and bearings should be verified daily.

69. Joints between sections of a belt should be constructed and maintained as tight as possible.

70. Coal falling on the cover plates and on the road floor under the belt should be cleared at sufficiently frequent intervals to prevent the accumulation of fine coal and dust.

71. Belts should be constantly cleared of coal dust as far as practicable by means such as wire brushes, vibrating rollers and scrapers.

72. Wood and other combustible material should not be left under the conveyor structure.

Diesel Locomotive Haulage

General Provisions.

73. The permission of the competent authority should be required for the use of diesel locomotive haulage in any mine or district of a mine.

74. Diesel locomotive haulage should not be used in any roadway where the firedamp content of the air current exceeds 1 per cent.

Personnel.

75. Only competent and properly trained persons should—

- (a) maintain and operate locomotives ;
- (b) accompany fuel containers underground ; and
- (c) transfer fuel to locomotive tanks.

Ventilation.

76. Adequate ventilation should be maintained in diesel locomotive haulage roads.

77. If the percentage of firedamp exceeds one in the air current in parts of roads where diesel locomotives are in use—

- (a) the engine of the locomotive should be stopped forthwith ;
- (b) the manager should be informed ; and
- (c) the operation of the locomotive should not be resumed until the percentage has been ascertained not to exceed one.

Fuel.

78. Fuel for the locomotives should have a flash point above 130°F (55°C), as determined in accordance with a recognised standard.

79. Fuel should only be taken and transported underground in strong, tight, metal receptacles or tank cars, closed by a screw cap or other device that is secured against working loose.

80. Tank cars and receptacles should be so closed that they cannot be opened by unauthorised persons.

81. (1) The manager should issue instructions setting out the precautions to be taken for the conveyance and storage of fuel underground and the filling of tanks.

(2) The instructions should be approved by the competent authority.

Locomotives.

82. Diesel locomotives should be of a type approved by the competent authority.

83. Diesel locomotives should be so designed that—
- (a) the fuel tank is protected against mechanical damage ;
 - (b) the fuel supply stops when the flow of cooling water stops ;

- (c) the combustion products do not contain dangerous quantities of flammable vapours ; and
- (d) the temperature of the combustion products does not exceed 160°F (70°C) in normal working.

84. Diesel locomotives should be equipped with suitable and adequate fire-extinguishing appliances.

Maintenance and Examination.

85. Diesel locomotives should—
- (a) be maintained in good working order ; and
 - (b) be examined in accordance with requirements laid down by the competent authority.

Operation.

86. The locomotive driver should cut off the supply of fuel to the engine—

- (a) during every break in operation, and
- (b) if a fire is suspected.

87. Locomotives should not be left unattended outside the depot unless the engine has been stopped and the brakes applied, and the engine cannot be started up by unauthorised persons.

88. Diesel locomotives should not be overloaded.

89. In gassy mines or districts, for starting up the engine use should only be made of ignition methods approved by the competent authority.

90. Ignition papers should be prohibited in gassy mines or districts.

Locomotive Depots and Filling Stations.

91. The floors of depots and filling stations should be even and impermeable.

92. Depots and filling stations should be well ventilated by a through air current.

93. (1) Depots and filling stations should be well lighted by electricity.

(2) All electrical equipment, including lighting equipment, should be of a construction affording protection against the vapours of liquid fuel.

Filling Fuel Tanks.

94. Locomotive fuel tanks should only be filled—

- (a) at filling stations authorised by the manager ; and
- (b) by means of a pump ensuring direct transfer.

95. Any oil spilled should be—

- (a) immediately taken up with sand or some other non-flammable absorbent ;
- (b) deposited in a metal receptacle ; and
- (c) removed from the mine as soon as practicable.

96. All empty fuel receptacles and tank cars should be removed from the mine daily.

97. No fuel should be transferred to any locomotive tank while any internal-combustion engine in the filling station is running.

Cutting Burners, Welding Appliances and Blowlamps

98. Cutting burners, welding appliances and blowlamps should be used, underground or in the headframe, only in the conditions approved by the competent authority.

99. Work in which use is made of cutting burners, welding appliances or blowlamps should be done only—

- (a) by competent persons appointed in writing for the purpose by the manager or his authorised representative ; and

(b) under the constant supervision of a competent official of the mine.

100. (1) Work with cutting burners, welding appliances or blowlamps should not be done underground—

(a) except at a place where there is no danger from firedamp or coal dust; and

(b) unless the sides at the place have been copiously wetted.

(2) During the work the air should be frequently tested for firedamp.

101. Adequate and sufficient fire-extinguishing materials and appliances should be immediately available at the workplace.

102. (1) As soon as work with cutting burners, welding appliances or blowlamps has been completed, and at frequent intervals afterwards, the place should be examined for fires or fire risks.

(2) In the case of work in the shaft, shaft landings, whether in use or not, and the shaft bottom, should be examined with particular care.

Naked-Light Mines

103. Naked lights should not be used underground, but in cases in which they are still used—

(a) the flames of open-flame lamps should be enclosed or protected;

(b) no naked light should be left in the mine unattended; and

(c) no naked light should be allowed to remain in touch with any wood or other combustible or flammable materials.

104. In naked-light mines—

(a) after firing shots with fuses the places should be examined to ensure that no fire is left burning; and

- (b) the personnel employed in building fire stoppings should be provided with safety lamps.

SECTION 2. ORGANISATION FOR THE PREVENTION, DETECTION AND FIGHTING OF FIRES

General Provisions

105. For the purposes of the organisation for the prevention, detection and fighting of fires the manager should—

- (a) prescribe measures for the prevention and detection of fires ;
- (b) draw up rules for giving warnings of fire, the evacuation of personnel, and the conduct of fire-fighting and rescue operations in case of fire ;
- (c) provide the necessary fire-fighting equipment ;
- (d) see that the personnel are familiar with the layout of the water piping system and with the positions of the hose connections, hoses and other fire-fighting equipment and materials near their normal place of work and that they know how to use the equipment ;
- (e) form and adequately train sufficient fire-fighting teams ;
- (f) provide telephonic or equivalent means of communication between suitable points underground and the surface such that underground personnel can be quickly warned in the event of fire ;
- (g) provide and keep up to date a sufficient number of sets of plans showing the layout of the fire-fighting equipment of each district of the mine, and giving such other information as may be useful for fire-fighting purposes ; and
- (h) have copies of the plans kept available at suitable places on the surface and underground.

Telephones

106. Where communication is by means of telephone—
- (a) telephones on the intake and return sides of active workings should be on separate circuits ; and
 - (b) telephones should be provided at the top and bottom of every shaft or other outlet, at each shaft landing and at each main loading station.

*Fire-Extinguishing Equipment and Materials**Water Supply.*

107. At all mines not naturally wet throughout a system of piping for water under pressure should be installed.

108. The system of piping should be sufficiently extensive and provided with sufficient hose connections suitably placed to enable water to be delivered in sufficient quantity and at a suitable pressure at every place in the mine where persons regularly work or pass.

109. Water piping should—

- (a) as far as practicable be of metal construction throughout ; and
- (b) be so connected that the water cannot be cut off by a fire.

110. Precautions should, where necessary, be taken, particularly on the surface and in the shaft, to prevent the water from freezing.

111. The cross-section of the piping should be such that at any time and at any point in the system an adequate flow of water at an adequate pressure is ensured for fire-fighting purposes.

112. The hose connections should be standardised throughout the mine.

113. The hose connections should be spaced at intervals approved by the competent authority.

114. Suitable lengths of hose that can be connected to the water piping should be kept at suitable places in the mine.

Fire Extinguishers ; Inert Material.

115. There should be provided at suitable places—

- (a) portable fire extinguishers in sufficient number ; or
- (b) a sufficient supply of suitable inert dust or sand, and suitable equipment for conveying and using the dust or sand.

116. Fire extinguishers that are liable to give off harmful fumes or gases should not be provided or used underground.

117. A sufficient number of persons, including all conveyor attendants and machine operators, should be trained in the use of fire extinguishers.

118. (1) Fire extinguishers should be examined, checked and refilled as often as may be necessary to ensure that they are kept in good working order.

(2) A record of the dates of refilling should be kept in a special register.

119. At regular intervals to be specified by the competent authority, and at least once a month, all the equipment and materials provided for fire fighting should be examined by a competent person appointed by the manager.

Shafts.

120. Shafts that are not very wet should be provided with powerful devices controlled from the landings or the surface that spray water immediately.

Roads.

121. (1) At places where there are still combustible supports in cross-measure drifts and other main airways, except in very wet zones—

- (a) fire-arresting zones at least 80 yds. (75 m) long should be established ; or
- (b) adequate automatic sprinkler installations should be provided.

(2) The fire-arresting zones and sprinkler installations should be so placed as to reduce as far as practicable the spread of fire from one district to another in the mine.

Staples.

122. Above any machine or pulley at the tops of staples, other than those that are of incombustible material or are very wet, powerful devices that spray water immediately should be provided.

Locomotives.

123. All locomotives should be equipped with suitable and adequate fire-extinguishing appliances.

Fire Depots.

124. A main fire depot should be established at the surface and on every main haulage level at a suitable place in the intake air current near a main shaft.

125. In fire depots, fire-fighting equipment such as tools, broaching equipment for water piping, hoses, lances, couplings, grappling hooks and extinguishers should be kept in sufficient quantities.

126. Smaller fire depots should if necessary be established in the different districts of the mine.

127. In or near each fire depot a fire truck loaded with fire-fighting equipment should be kept in readiness.

Detection

Inspections.

128. (1) Safety inspections by supervisory officials should be made of all districts of a mine at least once during each working shift.

(2) During the inspections attention should be paid to the presence of and the means of eliminating fire risks, and in particular those arising from the use of open flames and defective electrical equipment and from frictional heat from machinery, incorrect shotfiring, spontaneous combustion, firedamp and coal dust.

129. On each inspection a report should be made in the form and manner to be fixed by the manager or the competent authority and entered in a register.

130. The districts into which the mine is divided for the purpose of safety inspections should not be too large to allow the supervisory officials undertaking such inspections to carry out their duties in a thorough manner.

131. Every mine should also be inspected periodically in every accessible part by the manager or his assistants.

132. Unless an exemption is granted by the competent authority, on each idle day all districts of every mine should be inspected at least once by competent persons.

133. At the fan drift or fan outlet the air should be tested at suitable intervals for any evidence of burning.

Procedure in Case of Fire

General Provisions.

134. On the occurrence of any smoke or other sign indicating that a fire has broken out underground, the supervisory officials in charge of any parts of the mine

likely to be affected by the fire, by-products of combustion or any resulting explosion should cause all persons employed in such parts to leave them before there is imminent danger.

135. (1) If the danger is not imminent, persons should only remain in the parts of the mine in which there is a fire for the purpose of preventing danger and fighting fires.

(2) With due regard in gassy mines to the danger of explosion, and in all mines to the danger of reversal of the ventilation, work should only continue in the other parts of the mine with the permission of the competent authority.

136. When signs of fire have been noticed the mine air should be tested for carbon monoxide and other harmful gases immediately, and thereafter as frequently as may be necessary.

137. (1) When a fire occurs underground every workman who notices it should try to extinguish it and warn the nearest supervisory official as soon as practicable.

(2) This supervisor should notify the manager of the outbreak without delay.

(3) The outbreak should be notified without delay by the manager to—

(a) the competent authority ; and

(b) any other person whom it is proper to inform.

138. If the fire cannot be promptly extinguished the manager, or in his absence the supervisory official in charge, should take without delay the measures provided for in the rules referred to in paragraph 105.

139. Suitable precautions should be taken to prevent danger to persons from any harmful gases or smoke emanating from any fire.

140. If practicable, stonedusting should be reinforced in roads communicating directly with the seat of the fire.

141. When any place has been evacuated because of a suspected or actual outbreak of fire or heating, it should not be reoccupied until it has been examined and reported safe by the persons duly authorised for the purpose.

Stoppings.

142. The manager should prepare for the building of stoppings—

- (a) by indicating on a fire-fighting plan the site of main stoppings; and
- (b) by providing at suitable places the necessary material for building stoppings, such as sacks of sand, sacks of stone dust, bricks and cement.

143. In the case of mines or districts liable to spontaneous combustion the manager should prepare secure foundations for stoppings in main airways where this is necessary.

144. The manager should build stoppings—

- (a) if direct fire fighting has proved unsuccessful; or
- (b) if a firedamp explosion is to be feared.

145. The building of fire stoppings should only be undertaken under the constant supervision of the manager or a supervisory official appointed by him for the purpose.

146. During the building of stoppings a rescue brigade should be kept ready for action as near as practicable.

147. (1) In gassy mines, during the building of stoppings no persons should be allowed underground except those required for the purpose of the stoppings or for ensuring the safety of the mine.

(2) The competent authority, with due regard to the dangers of explosion and reversal of the air current which might affect other districts, may allow persons to continue work in other districts in which the ventilation is independent of the district in which the fire is situated.

(3) During the building of stoppings in non-gassy mines due regard should be paid to the danger of reversal of the air current if work in other districts is continued.

148. If, during the building of stoppings, an accumulation of firedamp or any other dangerous gas is to be feared—

- (a) air samples should be taken frequently and analysed quickly ;
- (b) before the construction of a stopping is begun, an adequate stone-dust barrier should if practicable be erected in the road length between the seat of the fire and the future stopping, and this length should be thickly strewn with stone dust ;
- (c) the preliminary stopping should be strong and of a thickness proportional to the road cross-section, and be built very quickly of material affording the greatest practicable protection against explosion ; and
- (d) the preliminary stopping should be traversed by ventilation devices that can be quickly closed and are designed to maintain the normal direction of ventilation.

149. If there is danger of a firedamp explosion, and if a decision has been taken to close the ventilation devices of stoppings and of preliminary stoppings, closing should be simultaneous in the intake and return airways.

150. At least one adequate air-sampling pipe should be built through all preliminary and definitive stoppings.

151. In view of the explosion risk, sampling should not begin until a suitable period has elapsed after the closing of the preliminary stoppings.

152. (1) The building of definitive stoppings should not be begun until samples of combustion gases taken from the air-sampling pipe of the preliminary stoppings show that no explosion is to be feared.

(2) During the building of the stoppings due regard should be paid to variations in the barometric pressure.

153. Water should not be allowed to exert pressure on the stopping or the surrounding ground.

154. (1) If an inflow of water into the burning area is to be feared, a water drain that can be closed with valves or other devices should be provided at the bottom of the definitive stopping.

(2) No air should pass in or out through the drain.

155. (1) So long as fire may be suspected behind fire stoppings—

(a) the stoppings should be regularly inspected to ascertain airtightness and temperature ; and

(b) samples of the atmosphere behind the stoppings should be taken and analysed.

(2) The results of the inspections and analyses should be entered in a register, and any unusual circumstances should be immediately reported to the manager.

156. The reopening of districts that have been isolated by fire stoppings should only be carried out—

(a) with the permission of the competent authority ;

(b) under the constant supervision of the manager or a supervisory official appointed by him for the purpose ; and

(c) by experienced workers.

157. Before opening a stopping sufficient material should be brought up to the stopping for reclosing it.

158. While stoppings are being opened a rescue brigade should be kept ready for action as near as practicable.

159. Reopened districts, and any other districts likely to be contaminated by the reopening, should not be re-

occupied until they have been examined and found safe by the persons duly authorised for the purpose.

160. (1) If a mine, or part of a mine, has been filled with water for the purpose of drowning a fire, it should be carefully ascertained whether the water gives off sulphuretted hydrogen.

(2) If such gas is found or is suspected, adequate measures should be taken to protect the workers against poisoning.

Rescue

General Provisions.

161. (1) The managers jointly and severally, or the competent authority, should take adequate measures in every coal-mining district for the safe conduct of rescue and other necessary work in mines after a fire or any other disaster.

(2) Measures taken by managers should require the approval of the competent authority.

Central Rescue Stations.

162. (1) There should be provided and maintained, at convenient centres, adequate central rescue stations, fully equipped for rescue work and for the training of rescue workers, unless a station rendering equally efficient service is maintained by each mine and approved by the competent authority.

(2) As a rule the radius of action of a central rescue station should not exceed 15 to 22 miles (25 to 35 km).

163. Every central rescue station should be placed under the immediate control of a competent superintendent who has been fully trained in rescue work and has had adequate practical experience underground.

164. The manager of every mine should affiliate the mine to the central rescue station, if one exists in the mining district, in such a manner as to acquire the right of calling for and obtaining the services of the station at any time.

165. Every mine should be connected by telephone or other reliable means to its central rescue station, if one exists, or, if not, to other nearby mines maintaining their own rescue stations.

166. All central rescue stations in one and the same country should make arrangements for effective co-operation in case of need.

Rescue Corps and Brigades.

167. Rescue workers, in sufficient numbers, should be maintained and organised—

- (a) by the provision of a rescue corps at the central rescue station and of rescue workers at the mine ; or
- (b) by the provision of rescue brigades at the mine.

168. (1) There should always be a sufficient number of members of a rescue corps at the station, or in its immediate vicinity, ready for action at all times.

(2) Effective arrangements should be made at every mine for summoning other rescue workers immediately their services are required.

169. (1) The manager should appoint a sufficient number of persons employed at the mine to co-operate with the central rescue corps in practices and in rescue operations.

(2) Such persons should—

- (a) have a good knowledge of the layout of the mine ;
and
- (b) have been fully trained in rescue work.

170. Each rescue brigade should consist of a captain and four or five other persons.

171. If practicable the mine operator should arrange that no more than two-thirds of the members of rescue brigades are employed underground simultaneously except for the purposes of rescue or training in rescue work.

172. The manager should make effective arrangements for ensuring that members of rescue brigades are summoned promptly to the mine in case of need.

Selection of Rescue Workers.

173. (1) Persons to be trained in rescue work should be carefully selected.

(2) They should, in particular—

- (a) be certified by a physician to be fit to undertake rescue work ;
- (b) be suitable for rescue work by reason of their coolness ;
- (c) have at least two years' practical experience of underground work ; and
- (d) hold an approved certificate of proficiency in first aid.

174. Every rescue worker should be medically re-examined at least once in every 12 months and should not continue to act unless he is certified as fit.

Instruction and Practice.

175. A sufficient number of competent instructors should be available at every central rescue station to train rescue workers.

176. If there is no central rescue station a competent instructor should be appointed at every mine for the periodical training of rescue workers.

177. Every person selected for training in rescue work should undergo courses of instruction and practices approved by the competent authority.

178. Every rescue worker should have been certified by the superintendent of the central rescue station if there is one, or if not by the chief of the mine rescue station, to be efficient and able to undertake rescue work with breathing apparatus.

179. Rescue workers who have been certified as efficient should periodically undergo further practices and instruction approved by the competent authority.

180. As far as practicable the training of members of central rescue corps should be such as to familiarise them with conditions in the various mines in which they may have to serve.

Rescue Apparatus and Equipment.

181. At every central rescue station and mine rescue station adequate and suitable rescue equipment should be provided and maintained in good order and constantly ready for immediate use.

182. Every central rescue station and mine rescue station should keep, in sufficient quantity, sets of breathing apparatus of approved types and necessary spare parts and all other equipment considered necessary by the competent authority for rescue operations and first aid.

183. The essential rescue equipment kept at the mine should, as far as practicable, be of the same types as the corresponding equipment kept at the central rescue station.

184. (1) All breathing apparatus and accessory equipment in rescue stations should be adjusted and tested at suitable intervals.

(2) The purity of the oxygen or the air used should also be tested.

(3) In each case the tests should be carried out in a manner approved by the competent authority.

185. Any accidents or dangerous occurrences arising from the use of breathing apparatus or the like should be reported to the competent authority.

Mine Rescue Rooms.

186. At every mine a suitable room, normally kept locked to make it inaccessible to unauthorised persons, and connected to the mine communication system, should be provided on the surface for the storage of rescue apparatus ready for use.

187. In case of accident, at every mine, rooms should be provided on the surface for—

- (a) adjusting, repairing and refilling the breathing apparatus in use ;
- (b) accommodating the rescue workers ; and
- (c) controlling the movements of rescue workers.

Equipment for Rescue Brigades.

188. Rescue brigades making explorations should be provided with equipment which enables them—

- (a) to assess rapidly the state of the atmosphere of the place where they are ; and
- (b) to note on the spot the information necessary for the scientific conduct of rescue operations, and, at least, the temperature, relative humidity, airflow, direction of air current and percentage of carbon monoxide and methane in the air.

Examination of Apparatus.

189. At every mine arrangements should be made to ensure the periodical examination of breathing apparatus by a qualified person who has been suitably trained.

Signals.

190. The code of signals for use in rescue work and training should be—

- (a) uniform for all mines ; and
- (b) approved by the competent authority.

Rescue Operations.

191. Rules for central rescue stations and all affiliated mines should lay down general directions to be followed in rescue operations, and should be approved by the competent authority.

192. If there is no central rescue station, common rules for the rescue stations of neighbouring mines, approved by the competent authority, should lay down general directions to be followed in joint rescue operations.

193. The manager should make rules defining the duties of all mine personnel who may be concerned when rescue operations are undertaken.

194. (1) While rescue operations are in progress—

- (a) a competent person, specially appointed for the purpose, should be in general charge of surface operations concerned with rescue ;
- (b) the mine telephone switchboard or other means of communication should be continuously manned ;
- (c) no person should enter the mine unless required for purposes of rescue and safety, and authorised persons should be provided with permits ;
- (d) for every rescue brigade working in vitiated air there should be a reserve brigade in fresh air as near as practicable and ready for action in an emergency ; and
- (e) as far as practicable, a base should be established underground.

(2) The base mentioned in paragraph 194 (1) (e) should—

- (a) be in fresh air as near as practicable to the site of rescue operations ;
- (b) be provided with detection and resuscitation apparatus ; and
- (c) be connected to the surface by telephone or equivalent means.

195. (1) Ample personnel should always be available to ensure continuity of the operations.

(2) Personnel engaged in rescue operations should be relieved at suitable intervals so as to avoid excessive fatigue.

196. Every rescue worker who has been ill, even slightly, should report the fact and be medically examined.

197. Persons who have worn breathing apparatus in protracted rescue operations should be medically examined after every working period and should not continue working unless found fit.

198. Captains of rescue brigades should—

- (a) give the members of their brigade clear instructions ;
- (b) watch over the working of the apparatus carried by the members of their brigade ;
- (c) not engage in any work other than directing the brigade ; and
- (d) see that the members of their brigade keep close together, using a lifeline if necessary for this purpose.

199. The entire brigade should withdraw if one member is unable to continue.

PART II

ADDITIONAL PROVISIONS APPLICABLE TO MINES LIABLE TO SPONTANEOUS COMBUSTION

General Provisions

200. Mines or independent mine districts liable to spontaneous combustion should be classified as mines or districts liable to spontaneous combustion by the competent authority after consultation with the persons designated for this purpose.

General Operating Precautions

General Provisions.

201. The competent authority should require the managers of mines liable to spontaneous combustion to draw up rules relating to the precautions to be taken with respect to fire risks and, in particular, relating to the methods of working, stowing, supplies of adequate incombustible material for stoppings and sealings and means of extinguishing fires.

202. (1) The manager should fix the points that workers entering the mine may not pass before the supervisory officials have reported that it is safe for them to do so.

(2) Such points should be marked in the mine by conspicuous signs.

203. (1) Irrespective of any other inspections that may be recommended by the present Code of Practice, every district beyond the points referred to in paragraph 202 should be inspected throughout as to safety by an accompanied supervisory official within a period not exceeding two hours before each shift begins work in the district.

(2) No unauthorised person should enter the district to begin work before such inspection has been made.

(3) For the purposes of this paragraph, shifts immediately succeeding one another may be treated as one shift.

204. Every workplace underground should be inspected as to safety by a supervisory official of the mine at least twice in every shift.

205. On idle days all districts liable to spontaneous combustion should be inspected at least once by special fire patrols.

206. (1) When traversing seams in cross-measure drifts—

(a) the supports should be so installed that the seam can be constantly watched ; or

(b) the coal should be extracted to an adequate depth.

(2) If coal is extracted when traversing seams in cross-measure drifts the cavities formed by the extraction of the coal should be packed tight with sand or other finely granulated stowing material and the packing should be properly maintained.

207. All necessary measures should be taken to avoid crushing of coal and the resulting leakage of air.

Coal Getting.

208. The coal should be extracted as completely as practicable, especially in disturbed zones and steep seams.

209. Abandonment of pillars or tongues of coal should be avoided as far as practicable.

210. (1) Except in bord and pillar workings, if complete extraction is not practicable, abandoned pillars should be isolated by tight incombustible packing or other effective means.

(2) In bord and pillar workings, when pillars are being extracted and if complete extraction is not practicable the panel should be isolated by tight incombustible packing.

211. In bord and pillar workings coal pillars should be of a size and shape adequate to prevent crushing of the coal.

212. (1) In bord and pillar workings, if the pillars are extracted, they should be extracted as quickly as practicable after formation.

(2) As far as practicable panels with independent ventilation should be so formed that it will be possible to isolate one from another easily if necessary.

(3) Panels should, as far as practicable, be so formed as to permit complete extraction within the incubation period.

213. Falls of ground in steep seams should be prevented as far as practicable by means such as—

- (a) suitable arrangement of the faces ;
- (b) selecting an appropriate speed of extraction ; and
- (c) continuous and compact packing, or complete power stowing.

214. If chimneys and chutes have to be built in steep seams, they should be packed or stowed tight when no longer used unless caving is regularly practised.

215. Fallen coal should be—

- (a) removed promptly and completely ; or

(b) if removal is impracticable, sealed by slushing, injection of cement or other effective means.

216. After a fall of ground in steep seams, if quick removal of fallen coal is impracticable—

- (a) the fallen ground should be made airtight by effective means and a new raise should be driven ; or
- (b) the ventilation short-circuit across the fallen ground should be eliminated by the construction of an airtight stopping and a new air passage should be built.

Packing, Stowing.

217. When packing or stowing face roads in steep seams accumulations of fine coal should be removed from between the loading hoppers.

218. In mines where caving is practised, if there is a risk of spontaneous combustion, the intake and the return airways in the caved area should be protected by packing as complete and tight as practicable.

Withdrawal of Supports.

219. If it is decided to withdraw supports they should be withdrawn as rapidly as practicable.

220. If supports cannot be withdrawn rapidly the air current in the return airway should be tested frequently for carbon monoxide.

221. After the withdrawal of supports, workings should be isolated by tight stoppings of incombustible material and of sufficient length.

222. Seams in close proximity to sealed-off areas in which a fire is still active should not be worked if they are liable to be affected by the fire.

*Detection and Fighting of Fires**Carbon-Monoxide Control.*

223. The air in the return airway of each independent ventilation district classified as liable to spontaneous combustion should be—

- (a) tested at least once a day with an officially approved carbon-monoxide detector ; and
- (b) completely analysed at least once in every week with a view to determining the ratio

$$\frac{\text{CO formed}}{\text{O}_2 \text{ absorbed.}}$$

224. (1) If successive tests show a steady increase of the ratio referred to in paragraph 223 measures should be taken to determine the site of the heating and, if practicable, to suppress it.

(2) If it is impracticable to suppress the heating the district should be evacuated and effectively sealed off.

Fire-Extinguishing Material.

225. (1) Sufficient material for extinguishing fires by slushing, guniting, injection of cement or other effective means should be kept in readiness for transport and use.

(2) A sufficient number of persons should be trained in the use of this material.

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