EUROPEAN COAL AND STEEL COMMUNITY

THIRD REPORT

OF THE MINE SAFETY COMMISSION

NOVEMBER 1966

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INTRODUCTION

The Mines Safety Commission, which was set up in virtue of a decision (1) taken by the governments represented in the Council of Ministers in the Council meeting of 9th and 10th May 1957, has so far issued two Reports on its activities.

The first Report covered the period 1957 and 1958 and the second covered the years 1959 and 1960.

This, the Third Report, sets out the activities of the Commission during the period 1961 to 1965.

All the recommendations, reports, expert reports and guiding principles prepared by the Working Parties and their sub-committees and reported on in detail hereafter, were presented, in accordance with the terms of reference of the Mines Safety Commission, to the Community Governments and to the interested authorities for further action or for information; this was done immediately following upon their acceptance by the Safety Commission.

(1) The text of the terms of reference and rules of procedure of the Commission : Annexes XIV and XV, pp. 155 and 159.

PART ONE

ACTIVITIES OF THE COMMISSION

With the exception of the examination of a new programme of work, all the tasks of the Working Parties set up right at the beginning of the Commission's activities were carried out; the Working Parties set up sub-committees to examine various special problems.

The following Working Parties dealt with the technical problems of :

- "Fires and Underground Combustion",
- "Rescue Arrangements",
- "Winding Ropes and Shaft Guides",
- "Electrification".

The working group for "Combustible Dusts" was set up to establish a new programme of work, but this body was able to start work only at the beginning of 1966.

Problems associated with human factors were dealt with by the following Working Parties :

- "Psychological and Sociological Problems of Safety in Mines",
- "The Effects of Working Hours on Safety",
- "The Effects of Systems of Payment on Safety",
- "Medical Problems of a Mine Safety Policy".

In each Working Party (1) the chair was occupied by a Government representative.

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(1) The membership of the various Working Parties and their sub-committees is given in Annex XVI, together with a table of the meetings held.

C H A P T E R   O N E

TECHNICAL PROBLEMS

A.- FIRES AND UNDERGROUND COMBUSTION

I.- Explosion-proof fire stoppings

1. Plaster stoppings

When promulgating its Recommendation regarding the sealing-off of open fires and heatings underground, the Mines Safety Commission declared, in its plenary session of 20.12.60, in favour of looking for new designs and materials to be used in the erection of fire stoppings. It was unanimously agreed that quite a considerable number of practical tests would have to be carried out to provide a basis for developing the best possible design of stopping to be used against fires where there was also a risk of explosion.

At the request of the Safety Commission, the High Authority approved financial support for a programme of experiments drawn up by the Working Parties for "Fires and Underground Combustion" and "Rescue Arrangements"; the practical execution of this programme of trials was entrusted to the Experimental Roadway Association in Dortmund with the cooperation of specialists from the Main Mine Rescue Station at Essen-Kray.

The main question was to discover the extent to which it was possible to replace the hitherto conventional sandbag stoppings - used in firefighting operations where there was a risk of explosion - by stoppings made of other materials, which might make erection of the stoppings quicker, easier and less dangerous, and which might also offer better resistance to an explosion. This point was to be investigated by means of experimental explosions against stoppings made of sandbags, stonedust, cement and water, plaster and water, water bags etc. The experimental programme was commenced in October 1961 and terminated in May 1963. Out of a total of 27 experimental explosions, 11 were carried out using plaster-and-water-bag stoppings.

It was clear from the test results obtained that the erection of plaster stoppings to seal off open or concealed fires underground offers considerable advantages, this type of stopping having given the best results with regard to rapidity of erection and resistance to explosion.

The principle of the construction of plaster stoppings is that the plaster-of-paris is pumped in pneumatically, in a dry state, by means of compressed-air reservoirs, through hoses so that it fills the space between two light lagging screens; once in place where the dam is to be built, the plaster is wetted. Material consumption is 75% less than with sandbag stoppings. The smaller quantity of material required and the use of pneumatic transport reduce the construction time and the number of manshifts to be worked to less than half the requirement for sandbag stoppings. Moreover, the fact that transport is by hose means that the material can be carried over fairly long distances, and the task of transporting it is lightened.

One major advantage from the safety point of view is that, out of the teams involved in the work, only a small observer group of about two men need remain in the direct danger area at the stopping construction site, while all the other men can be much farther away (up to 300 m), at the point where the compressed-air reservoir is set up; this means that in most instances they are in a flow of fresh air.

On the basis of these results, together with the fact that plaster stoppings have already been used by the Main Mine Rescue Station at Essen-Kray in fighting various mine fires or in sealing-off abandoned workings successfully, the Working Parties prepared an expert report regarding the construction of plaster stoppings as a means of combatting mine fires, and established guiding principles which are to be borne in mind in erecting such stoppings.

These guiding principles indicate :

- the choice and deployment of the materials (plaster, building materials) and
- deployment of the equipment (air reservoir, pneumatic transport pipes, water nozzles, flowmeter, distribution units, hoses and snuffle pipes).

They give descriptions of the preparatory work

- at the site where the dam is to be built,
- at the point where the compressed-air reservoir is set up.

The guiding principles finally contain suggestions for the finishing-off work and for efficient protection of the men against the clouds of dust produced during the pneumatic transport operation.

At its plenary session of 27th and 28th April 1964 the Mines Safety Commission examined the report presented by the Working Parties, together with the final report by the Experimental Roadway Association. The Commission accepted the report as well as the statement of policy, together with the guiding principles, and advocated the erection of plaster stoppings for sealing-off open and hidden underground fires in all cases in which this method can be used and shows advantages over sandbag stoppings. The following advantages guided the Commission in this action :

- increased resistance of the dams to explosion,
- shorter time required for construction and
- increased safety for the teams of men building the stoppings.

The text of the Report together with the statement of policy and guiding principles, as well as the Final Report of the Experimental Roadway Association were sent out on the 20th May 1964 to all the governments represented on the Mines Safety Commission and to all bodies interested in this problem (research institutes, main mine rescue stations, employers and workers' associations etc.).

It is included in the present Report as Annex I (1) and in the Appendix to the Report as Annex Ia (2).

2. Foamed urethane seals

In 1963 the Mines Safety Commission instructed the Working Parties to give increased attention to the application of urethane foam, after one of the member countries had successfully sealed the stoppings in a fire area with foamed urethane, and after urethane foam stoppings had been used in two further serious cases - the Mines Inspectorate having issued an exemption in view of the urgency of the case.

The Working Parties are fully aware that underground use of a plastic must, in the first instance, be made dependent upon it having high resistance to flamability and no associated health risk.

The Working Parties are currently studying experience gained in practical underground employment of foamed urethane in the Community countries and in the United Kingdom. They are also examining findings obtained from a series of experiments into the propagation of fires, carried out in the experimental

(1) Present Report, Annex I.

(2) Appendix to Report, Annex Ia.

roadways of the Safety Co-ordination Centre in Hasselt with materials from various manufacturers.

In view of the very differing nature of the materials available, the point to be settled is whether a product can be used in individual cases without previous practical testing. To date it is necessary to carry out full-sized trials of every product before it can be used in practice.

The comparability of these products in respect of quality and the degree to which the test results are generally recognised as authoritative present further difficulties. The Working Parties are therefore studying whether it it advisable - to prepare a comparative survey indicating the test results and the properties - for all those materials which have been tested regarding resistance to flamability and freedom from health risks in the Community countries and in the United Kingdom. If maintained constantly up to date, a survey of this kind could facilitate and encourage the practical application of these materials.

In order to substitute a simpler process for the expensive and time-consuming full-sized fire trials, the Safety Co-ordination Centre in Hasselt is examining the suitability of a reduced-scale test procedure, using 70-cm diameter tubes.

Test methods for such substances are also being developed in North Rhine/ Westphalia. Appropriate guiding principles are being prepared.

II.- Opening-up of fire zones

The study of this problem was decided upon by the Safety Commission in its session of 20.12.60, at which the Recommendations regarding fire stoppings referred to above were accepted (1).

The Safety Commission was then of the opinion that the recovery of sealed-off fire areas must be dealt with, because none of the Inspectorates of the countries represented in the Mines Safety Commission had issued guiding principles regarding the most suitable procedures to follow. Only reports on work carried out in individual cases had been published hitherto.

The Working Parties for Fires and Underground Combustion and for Rescue Arrangements began to study this question after the Belgian, German, French and British delegations had reported on the methods of opening-up fire areas in the coal-mining industries of their countries and had described typical practical opening-up operations of such sealed-off fire zones and the preparatory work required. Taking the documents tabled as a basis, coupled with a study of a body of relevant source material, an expert (2) produced, at the request of the Working Parties and with the agreement of the Safety Commission, a study of this problem which took the form of a synoptic table.

This investigation made it possible to examine the problem in detail, to work out generally-applicable proposals for the opening-up of fire zones in the form of guiding principles capable of very wide application and to give to managements as yet inexperienced in work of this kind a clear idea of the factors to be borne in mind and the measures required in preparing and executing such work.

Precisely as in the case of the guiding principles for sealing-off mine fires (1), the Working Parties distinguished between zones where there was the risk of explosion and zones where there was not, in working out these guidelines.

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(1) Second Report of the Mines Safety Commission, page 51.

(2) Bergassessor a.D. Lehmann, Gelsenkirchen.

The detailed principles for the opening-up of sealed-off fire areas were classified as follows :

- general remarks regarding the factors governing the decision to open-up a fire zone and regarding the dangers which arise; these are followed by basic rules to be borne in mind when opening-up operations are begun.

There follow chapters on :

- opening-up fire zones containing non-explosive gas mixtures,
- opening-up fire zones containing gas mixtures which can become explosive when diluted with air and
- opening-up fire zones containing explosive gas mixtures.

In each case a difference was drawn between opening-up operations from one side only and on two sides (to provide through ventilation of the fire zone).

The guiding principles finally deal with

- opening of flooded fire zones and
- renewed manning of old fire areas.

In its Plenary Session of 16th October 1964 the Safety Commission accepted these guiding principles and expressed its satisfaction that it was now possible to refer to a guide to the opening-up of fire zones, with details of the measures and working operations required, although this guide was primarily intended only to indicate the possibility of the undertaking, since the decision in each individual case must be left to the responsible authorities.

The Safety Commission expressed its wish that these guiding principles and the text of the studies should be distributed to all interested circles.

The guiding principles, together with Bergassessor a.D. Lehmann's synopsis the study of which the Safety Commission particularly recommended, was made available to the Mines Inspectorate of the Community countries, as well as all other interested parties, on the 20th May 1964.

The text of these guiding principles is attached to this Report as Annex II (1), the text of the synopsis corresponds to Annex IIa (2) of the Appendix to the Report.

III.- Fighting fires in deep shafts

On the 8th April 1960 the Safety Commission finally approved guiding principles for fighting fires in deep shafts by sending down water (3).

The establishment of these guiding principles goes back to a Recommendation of the Conference on Safety in Coal Mines, which was based on the investigations into the shaft fire at Marcinelle in 1956 (4).

Among other things, these guiding principles formulate the requirement that

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(1) Present Report, Annex II, page 14.

(2) Appendix to Report, Annex IIa.

(3) Second Report of the Safety Commission, page 26.

(4) Report of the Conference, page 54, decision 2 - b).

- "a device must be installed at the head of each shaft going to the surface, which can provide a flow of water of at least 50 l/min and m^2 of shaft cross-section".

At the same time the Working Parties pointed out that putting in excessive quantities of water would cause disturbances in the ventilation and could thus cause additional danger to the men underground.

The Experimental Roadway Association in Dortmund carried out tests even before the approval of these guiding principles, and their experiments showed that the quantity of water indicated is sufficient to extinguish shaft fires at shallow depth.

However, this left open the question as to whether this quantity of water was also sufficient to extinguish a shaft fire at a greater depth. This type of fire is one which creates difficult problems, especially for collieries with deep pits, which are becoming more and more numerous.

The Working Parties therefore worked out, with the close collaboration of the Heads of the experimental stations of the Community countries and the United Kingdom, proposals supported by the Safety Commission, to carry out full-scale experiments :

- to examine the extinguishing effect of water fed into downcast shafts of some depth, taking into account the duration of supply and the quantity of water, and
- to study the ventilation disturbances, caused by the thermal lift due to the fire itself or to fire-fighting measures.

The Safety Commission was of the opinion that the test results gave a deal of information regarding the execution of the mine rescue operations, thus contributing to the safety of the men. It was not possible at this time to carry out full-scale tests, since the research institutes of the Community countries did not have at their disposal suitable shafts of the required depth.

The Safety Commission asked the High Authority for a financial grant for carrying out a practical research programme in a suitable pit, to be selected from the list of closed pits, and instructed the Working Party to work out a suitable experimental programme.

The Working Parties set up two committees of experts, one of which dealt with the examination of the practical problems, such as the requirements in the pit to be chosen, requirements in men and materials, cost estimates etc., while the other examined the problems of ventilation conditions, airflow conditions, thermal lift, and the measuring procedures to be used from a scientific point of view. These committees were strengthened by the co-option of experts from the research stations, in particular ventilation specialists.

The programme worked out by the two committees of experts could, in the first instance, be no more than a skeleton programme, which would, in any event, have to be adapted to the actual conditions of the shaft to be used for the experiment once the name of the selected pit had been made known.

When the closure of the Dorstfeld Colliery near Dortmund made available a suitable shaft for the experimental programme to be carried out, the committees of experts referred to above studied the shaft available and adapted the programme which they had worked out, and which had been approved by the Safety Commission, to the conditions actually obtaining at Dorstfeld Colliery. It soon became clear, that one could not expect to provide full explanations of all the problems encountered, but it would be possible to obtain adequate information regarding the question of the water supply.

The modified programme provided that the fire test should determine :

- whether it is possible to extinguish a well-developed fire in a shaft over 800 m deep with a water flow of 50 litres per minute and m^2 of shaft cross-section,

- whether sending down water produced changes in the ventilation and
- whether a ventilation reversal could occur as a result of the thermal lift due to the fire itself.

Even before the beginning of the experiment it was known that one could hardly expect to obtain an explanation of the last question - air reversal in this shaft - as the existing ventilation conditions were exceedingly stable because of the existing simple ventilation system, using one downcast and one upcast shaft, and because of various changes in the mine layout made for safety reasons.

Experiments showed that an artificially-raised fire of great intensity - such as would probably hardly occur in practice - could be extinguished. On the basis of this result, the experts consider it probable that a quantity of water corresponding to that named in the guiding principles is sufficient to extinguish any fire in a shaft.

During the test it was possible to observe the formation of pulsating combustion fumes and a forced expulsion of the fumes, and it was also possible to analyse the composition of the combustion fumes and measure their temperature.

No decisive information could be obtained from the test with regard to ventilation.

The members of the Working Parties simultaneously came to the same conclusion as the committee of experts, that this fire test was capable of answering only some of the existing questions, and that in order to solve the problems still unresolved (if it were possible to carry out a second large-scale test) close attention must be paid to the following points on the programme :

- a non-stable ventilation system,
- the centre of the fire should be at medium or shallow depth in a deep shaft with an increased aeromotor counter-action,
- the fire should be extended vertically along the shaft walls,
- the initiating fire should be small etc.

Views expressed on the judgment of the committees of experts and their conclusions with regard to continuation of the research were not unanimous, either in the Working Parties or in the sub-committees.

The Report of the Working Parties and the Final Report of the Experimental Roadway Association were placed on the agenda of the Plenary session of the Safety Commission of the 19th and 20th July 1965.

A lively discussion arose with regard to the continuation of the experiments, in particular regarding the question as to whether the remaining unsolved questions should be resolved by carrying out a second large-scale test or by model tests, or whether it was necessary to have a large-scale test with supplementary model tests.

Those in favour of a large-scale test hoped that it would provide an answer to the question as to whether a fire extended vertically could be extinguished as quickly (as had been the case at Dorstfeld) as a fire - governed by the arrangement of the burning material - which developed primarily in the horizontal direction.

On the other hand, some members held the view that a single large-scale test would not be sufficient to clear up outstanding questions or to establish generally-applicable rules, by reason of the basically different ventilation conditions at each individual colliery and the very varied conditions within any given pit.

As against this, the model tests should be able to provide an explanation of the flow conditions and of the pulsating ejection of fumes, such as were observed during the Dorstfeld trial, and thus provided information - before carrying out any full-scale test which might be decided upon - regarding the importance of thermal lift, which can affect the amount of water sent down. Moreover, suitable measurement methods would have to be made ready.

The possible use of model tests was objected to on the ground that results of trials carried out in two countries in a model roadway had as yet not provided any information as to the extent to which they could be applied to practical conditions.

Recognizing the diversity of views, the Safety Commission supported the proposals formulated by the committee of experts regarding further investigation of this question with certain reservations.

These proposals envisage that the problem of fire fighting in fairly deep shafts by sending down water should be dealt with as follows :

a) Before any new large-scale test which might be decided upon is carried out, existing results of research regarding :

   - pulsating counterflow near the source of the fire and
   - the danger of pulsating emission of combustion fumes

   should be collated and critically analysed.

b) If the results of this analysis were to make it appear advisable to continue the investigations, by means of model tests, such model tests should be directed towards :

   - examining the flow phenomena in the vicinity of the seat of the fire with various arrangements of the burning material
   - the determination of the maximum intensity of a shaft fire where air supply is limited and
   - the development of measurement methods for such large-scale tests as might be decided upon.

c) Independently of this, should a favourable occasion present itself for carrying out a large-scale test at low cost, this should be done with due consideration of the conditions listed under point 2 of the conclusions (1) of the Committee of Experts, but with the restriction :

   - that before proceeding to a further large-scale test, an inventory should be taken of those pits in Community countries which possess the desired characteristics for the experimental shaft, to guarantee that - bearing in mind the expenditure necessary for carrying out this test - the results to be expected should be applicable to the largest possible number of shafts in practice.

Only once this inventory has been tabled will the Safety Commission examine the desirability of carrying out a further large-scale test and what new results might be expected from it.

The Safety Commission expressed the wish that the investigations named under Point 1 of paragraph 1 of the conclusions (1) should be put in hand as soon as possible, i.e. the questions as to :

- what results it has been possible to obtain to date in the Community countries and elsewhere with model tests,
- whether, in the light of these results, it is in the present instance worthwhile carrying out model tests or not.

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(1) Appendix to the Report, Annex III b.

The Committee of Experts dealing with "Theoretical Problems of Shaft Fires at fairly Great Depth", assisted by experts in flow phenomena, has meanwhile begun the study of this field.

The experimental programme, the course of the experiment and the results are given in detail in the Report (1) of the Experimental Roadway Association in Dortmund. The Committee of Experts had worked out a special document (2) on this Report; this document was unanimously accepted. The Working Parties, on the other hand, considered clarifications (2) were called for to give a clearer understanding of this Report.

IV.- <u>Specifications and Tests for Fire-resistant Fluids used for Power Transmission and Control Purposes</u>

As set out in the Second Report of the Safety Commission, the Committee of Experts entrusted with the preparation of criteria and testing methods for fire-resistant fluids has produced a Report (3) on these problems; in accordance with a decision of the Safety Commission this Report has been distributed to all responsible authorities in the petroleum, chemical and mechanical industries and in the coal-mining industry, to keep them informed of developments in this field and with regard to the lines being followed by the work so begun. This information report was accepted on 20/12/60 and published on 24/2/61.

In the meanwhile, further detailed investigations have been carried out with regard to the formulation of fire-fighting and technical criteria.

It was necessary to carry out many comparative tests in the laboratories of : Technischer Ueberwachungsverein e.V. in Essen, Versuchsgrubengesellschaft m.b.H. in Dortmund, Houillères du Nord/Pas-de-Calais in Douai and also at the Institut National des Mines, Pâturages, in order to check the criteria worked out by the Committee of Experts, to develop new experimental devices and to lay down further test methods.

Progress in the criteria affecting mine health and safety and the development of test methods in this field received particular attention, as a result of the cooperation given by highly-qualified medical experts.

The Committee of Experts presented in 1964 its "Second Report on Specifications and Testing Conditions Relating to Fire-Resistant Fluids used for Power Transmission and Control"; this Report takes into account the most recent knowledge in this field. The investigations are being continued.

The purpose of this Report was to provide standardized criteria and testing methods for all the Community countries and thus to ensure that a hydraulic fluid intended for use underground should be judged by the same criteria, and not approved for use in one country and refused certification in another.

To be sure that work towards this objective proceeded on a sure foundation, the Directors of Research Institutes represented in the Committee of Experts agreed to exchange information on the results of tests of the individual products available and, moreover, to keep informed those institutes in the Community countries which do not at the moment possess practical test experience in this field.

It is worth noting the proposals put forward by the Committee of Experts with regard to the conditions of approval (Article 1 of the second part of this Report) :

(1) Appendix to the Report, Annex III a).

(2) Appendix to the Report, Annex III b).

(3) Second Report of the Mines Safety Commission, page 59.

"1. Fire-resistant fluids for hydraulic powered transmission and control must, before being used in mine workings, be given a certificate of approval indicating that they have passed the following series of tests :

   a) Laboratory tests corresponding to the methods described in the Report for the determination of technical criteria of flamability, health criteria and technical criteria,

   b) Long-duration tests in normal use.

2. The series of tests must be placed under the control of a specialist institute.

3. Approval of the use of these fluids in mine workings is dependant on production of the certificate mentioned above".

The Safety Commission formally approved this Second Report in its plenary session of 16th October 1964, noting with satisfaction that the completion of this Report had attracted interest which went beyond the boundaries of the Community countries.

The text of this Second Report is annexed to this present Report in the form of a brochure (Annex IV a) (1). It was despatched, with a preface by the Chairman of the Mines Safety Commission in the four Community languages, as well as in English, on 18.11.1964, to Mines Inspectorates of the Community countries for further action and to all the other interested parties named above for purpose of information.

V.- Ventilation Measures (Prof. Budryk's theory)

In its plenary session of 20.12.1960, the Mines Safety Commission declared its agreement to a suggestion put forward by the Working Parties for "Underground Fires and Combustion" and "Rescue Organisation" to set up a sub-committee of ventilation experts to examine Prof. Budryk's theory on ventilation measures as a part of fire fighting, and their application in the Polish mining industry, so that they could if appropriate present the appropriate conclusions for the coal-mining industries of the Community countries.

This sub-committee has in the meanwhile prepared a first provisional report of its work. A series of new facts has been established and provisional conclusions reached, and the sub-committee has reported its views regarding the following points in the theory worked out by Prof. Budryk :

- the required information regarding the ventilation conditions of a pit;
- the importance of the idea of the "main flow current" introduced by Budryk;
- basic formula for the determination of ventilation direction in a mine working; and
- practical steps to stabilize ventilation direction.

In this First Report the sub-committee of experts accepted the theory of Prof. Budryk in principle and drew attention to numerous questions, especially those relating gassy mines, to which answers had not yet been found.

This report was laid before the two Working Parties. After examining it, the Working Parties did not, however, consider it appropriate to submit it to the Safety Commission in its provisional form. The Committee of Experts made every effort to clear up the questions remaining open by correspondence with the responsible Polish authorities. The great complexity of the overall problem and its very difficult technical content made it impossible to reach a clear understanding, satisfactory to all parties, on every occasion; moreover; there were unexpected differences of opinion regarding the practical application of this theory.

(1) Appendix to Report, Annex IV a.

For this reason, the Polish authorities responsible proposed to the experts that they should visit the Polish coal-mining industry to clear up the outstanding questions on the spot. The Mines Safety Commission agreed that a study visit should be made by a few qualified representatives of the Committee of Experts, in view of the importance of the Budryk theory and its possible future application.

The questions to be dealt with were primarily :

1) to what extent application was made of the measures derived from Prof. Budryk's theory to achieve stabilization of the ventilation in the event of the mine fire, in particular in gassy mines or those with a high firedamp risk and at descensionally-ventilated working-points in the Polish mines;
2) how the special representations of ventilation conditions used in Poland were prepared and what use was made of them in the fire fighting operations.

In addition information was to be obtained regarding :

3) the determination of the tendency of coal to spontaneous ignition and the estimation of the risk of spontaneous ignition in faces;
4) timely recognition of spontaneous ignition and
5) supervision of sealed-off fire zones and the opening-up of sealed-off workings.

The experts' report on their study visit, which took place from the 5th to 13.12.1964, showed that they obtained the desired clarifications and explanations and that they were now in a position to issue very soon their final report with regard to Prof. Budryk's theory and its practical application.

VI.- Discussion of Mine Accidents

It is not necessary to emphasize that mine accidents which can give useful information and whose causes and conditions are directly related to topical problems being dealt with by Working Parties are the subject of special discussion.

In most instances the accidents in question are those which are listed in chapter Three of this Report.

B.- MINE RESCUE

I.- Organization of Rescue Operations

1. Supra-national aid - Expert advice in the event of a major accident

Following on the approval of the Report on the visit to the Main Rescue Stations of the Community countries and of the United Kingdom (1), the Working Party on "Mine Rescue Operations" first of all devoted its attention to the problems left open in that Report, the above problem being one of these; this was done on the basis of the conclusions drawn by the Permanent Commission.

After the Working Party had finished examining this question and had reported to the Permanent Commission on the results of this study, the Permanent Commission decided on 12.12.61 that - after detailed examination of the results recorded in the Report on the visits to the Main Rescue Stations in the

(1) Second Report of the Mines Safety Commission, Annex B.

Community countries and in the United Kingdom, as also on the basis of practical experience available up to that time with regard to the close relations already existing between the Main Rescue Stations of neighbouring countries - it did not in general seem necessary to recommend preparations for organizing supra-national aid in the event of a major accident.

On the other hand, the Safety Commission did consider it advisable to formulate a Recommendation regarding the provision of expert advice with regard to measures to be taken in respect of major accidents by experts from other countries.

This Recommendation, the text of which is attached as Annex III (1), was approved on 12.12.1961 and transmitted for further action to the Mines Inspectorates and to the Main Rescue Stations of the Community countries on 15.2.1962.

2. Communication links between standby base and rescue team

The discussion of a fatal accident which occurred while a rescue team was in action led to an exchange of experience regarding communication links between the standby base and the rescue team.

In the light of this discussion the Working Party considered it advisable to examine the question of the provision of a communication link between the rescue team in action and the standby base and also between the standby base and the leader of the rescue operation, with a view to making available information regarding the technical design of the apparatus used and of the methods employed, as well as to compare the various views held in this field in the Community countries and, if this seemed appropriate, to table general proposals.

The provision of this communication link is of special importance, not only for the team in action, but also for the standby base and for the leader of the rescue operation in respect of the decisions to be taken and their rapid communication during the period when the team is operating.

Questionnaires were used to record the methods employed in the different countries and to list the existing instructions in this respect, and to compare these records.

The results of this investigation can be summarized essentially in the following proposals, which are formulated by the Working Party for the further development of telephone apparatus and equipment :

"a) Masks

Since only breathing masks will be used for telephoning, attempts should be made to improve them with regard to the following features :

- air-space and gas-tightness, field of view, weight, means of attachment.

b) Connection with the telephone wire

Needle plug units (prickers) already exist for thin telephone cables. The development of other plug-in devices for other types of cable would be welcome.

c) Weight and size of the apparatus, of cable drums, of cables etc.

Should be adapted to the conditions in which the rescue team will have to use them when operating.

(1) Present Report, Annex III, page 343.

d) Amplifiers

Flameproof amplifiers of small and lightweight design should be developed, to ensure better understanding where the connection is bad.

e) Wireless radio

Development of an effective wireless-telephone system".

The execution of this investigation and the results obtained are described in detail and summary form in a tabulation (Annex IV) (1), which was approved by the Safety Commission in its plenary session of 14th and 15th.2.1966 with the instruction that the rescue stations and manufacturers of telephone equipment should be apprised of this information; if necessary, the advisability of holding a competition should be examined.

3. Annual report on the organization of the Mine Rescue System

The Report, referred to above, on the visit to the Main Rescue Stations is at the same time the first Report of the Working Party regarding the organization of mine rescue operations and deals with the state of affairs from the end of 1959. The Working Party was charged by the Safety Commission to continue the exchange of experience in order to be in a position to present to the Commission an annual report on the developments in mine rescue organizations.

The first Report for the year 1959 contained a detailed survey of the organization of mine rescue systems and consequently paid particular attention to the instruction and training of the rescue team personnel, the organization of a rescue operation, the reciprocal aid in the event of major accidents, the use of oxygen-recycling breathing apparatus and other available equipment, the provision of breathing apparatus for gassy atmospheres always in a state of readiness, the preparatory measures for major accidents etc. As against this, future annual reports will be prepared only in a summary form and will follow a standard list of headings dealing with the following groups of problems :

- Structure of mine rescue organizations :

  Rescue stations and personnel,
  Equipment with recycling apparatus.

- Measures in serious accidents :

  To protect men,
  To protect equipment.

- Accidents in breathing apparatus for gassy atmospheres.

- Results from research and development.

To give the report a clearer form, details will be given only regarding the most important districts in each country, it being realized that for this reason and because of the varying conditions within the different districts, comparison between the statistical data given in the reports will be limited.

The members of the Working Party will furthermore be able to study individual problems in greater detail by a systematic exchange of the annual reports of each of the Mines Rescue Stations.

In each case, when the annual report has been finished, there will be a discussion in the Working Party regarding the notable cases of accidents reported on therein as well as on various questions arising from the report. Experience has already shown that this will provide valuable pointers with regard to the further development of the organization of mine rescue operations.

(1) Present Report, Annex IV, p. 347.

Up to the present, this layout has been adopted for the reports for the years 1960, 1961, 1962, 1963/1964; the text of these reports is attached to the present Report (Annex V a - VIII a) (1). In accordance with a decision of the Permanent Commission, a two-yearly report will be issued for the years 1963 and 1964 for the first time.

II.- Selection and training of mine rescue workers

1. Development of a simple method to test the heat resistance of actual or would-be mine rescue workers

When the rescue operation was being carried out after a mine accident, a mine rescue worker of the Main Rescue Station at Frâmeries (Belgium) was overcome by heatstroke. At the same time, several other rescue workers who showed signs of excessive exposure to heat, were able to be carried out in good time and revived.

These accidents led the Main Rescue Station at Frâmeries to make a special study, (with the cooperation of specialist doctors) of the problem of the selection, training and acclimatisation of rescue teams for work in high temperatures and at high humidities.

Within the framework of these investigations mine rescue workers were subjected to a series of acclimatisation exercices , the degree of difficulty of which was increased from one exercise to another, to improve the resistance of the men in respect of their capacity to stand heat in moist and hot surroundings, if possible. Since this capacity of resistance varies from one individual to another, there are considerable differences in this respect between the individual mine rescue workers who make up a rescue team.

During these suitability exercises, and in spite of the greatest care taken in the Main Rescue Station of Frâmeries, various troubles arose - fainting, giddiness etc. - which could not simply be attributed to insufficient acclimatisation.

To reduce the risks which had arisen during rescue operations in very hot and moist conditions, the development of precise but simple criteria could be very useful; these criteria could be used to select mine rescue workers who from the beginning were suitable for rescue operations in high temperatures without it being necessary - as hitherto - to carry out expensive and time-consuming acclimatisation exercises to establish their capacity to resist heat. The Belgian experts held the view that these criteria could be formulated by means of a suitable research programme. The Working Party for Mine Rescue Operations approved of this view.

In its plenary session of 12th December 1961 the Safety Commission declared its agreement that the Centre National Belge de Coordination des Centrales de Sauvetage in Charleroi should carry on the proposed research, approved by the Working Party.

This research project was entrusted to the Main Rescue Station at Frâmeries by reason of their experience in this field. Together with the doctor responsible for this research and in cooperation with medical experts from various Community countries and from the United Kingdom, the Working Party prepared the research programme. In accordance with the agreement reached between the High Authority and the Main Rescue Station at Frâmeries, the research work was scheduled to begin in August 1962. The Main Rescue Station at Frâmeries carried out the tests laid down in the experimental programme as had been agreed, using a specially selected test personnel.

In September 1965 the Working Party examined for the first time the final report on the work carried out at Frâmeries and reached the conclusion that

(1) Appendix to this Report, Annexes V a, VI a, VII a and VIII a.

the results obtained gave the Main Rescue Stations criteria which might possibly be suitable to select a restricted number of mine rescue workers for operations, in respect of their tolerance of heat. The Working Party were unable to reach a final judgement on this point, since the principal yardstick employed was the change in cardiac frequency, in respect of which a sufficient body of practical experience is not yet available. The Safety Commission considered the results in its plenary session of 14th and 15th 2. 1966 and agreed with the Working Party's proposal to wait for data to become available from the practical use of these criteria and

- to commission the Main Rescue Station in Frâmeries to select mine rescue workers and would-be rescue workers in the future on the basis of the criteria laid down and to make a report on the practical experience gained by the centre as soon as possible, and also
- instructed the centre to distribute the research report reference (1) in the form presented to all the Main Rescue Stations of the Community countries and of the United Kingdom for information, and to encourage them to apply the test described therein even before the Main Rescue Station of Frâmeries published its own results, asking the other rescue stations also to prepare reports on their results, in order to obtain a broad basis of experience.

2. Training teams responsible for erecting plaster stoppings

Some of the members of the Safety Commission expressed the wish that the guiding principles for the construction of plaster stoppings, already referred to (2), should be supplemented by suitable diagrams to make it possible to understand the individual stages of the process clearly. The majority of members were, however, of the opinion that it would be better to examine all the questions with regard to the training of the men entrusted with the construction of plaster stoppings and to bring all the points together in an instruction leaflet.

Since it is primarily the mine rescue personnel who are concerned with building plaster stoppings, the Working Party "Mine Rescue Operations" was entrusted with studying these problems in collaboration with the Main Rescue Stations and with preparing a training programme for the training of the personnel involved.

To help them in studying this question, the Working Party had available documents from the Main Mine Rescue Station at Essen-Kray and from the National Coal Board. The Working Party recommended the acceptance of an expanded text prepared by the Main Mine Rescue Station at Essen-Kray under the title of "Instructions for the construction of Plaster Stoppings", since this document, based on practical experience in the Ruhr where the construction of plaster stoppings is increasingly favoured, is assuming particular importance.

The guiding principles set out above were incorporated in the instruction leaflet and the principles to be observed during training were described under the following headings :

- Availability and transport of plaster
- Requirements of material
- Preparation of proposals
- Preparation and execution of the filling operations
- Testing for air- and gas-tightness
- Sealing off the stopping.

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(1) Appendix to this Report, Annex IX a.

(2) Present Report, p. 17.

The Working Party presented this introduction to the Safety Commission as the fruit of its investigations into this problem. In the plenary session of 14 and 15.2.1966, the Mines Safety Commission examined this instruction, which they accepted with the recommendation that the responsible services in the Community countries should be encouraged to carry out the training of the personnel responsible for building plaster stoppings in accordance with this instruction.

The text of this instruction for the building of plaster stoppings is reproduced in Appendix X a (1).

3. Use of smoke powders to simulate smoke in practice galleries

In the light of a comparison of the smoke-producing substances and methods used in the Community countries and of the regulations applying thereto, the Working Party formed the intention to find a suitable smoke powder which could, if this seemed appropriate, be recommended as a standard powder for general use by Mine Rescue Stations.

After discussion, it was however agreed that the study of this problem should be taken up again at an appropriate time in connection with investigation of the entire group of problems of training rescue teams in practice roadways; at this time it would be possible to work out the specification to be met by such a powder and a suitable method for exercises in smoke-charged atmospheres, these texts to be given to the Mine Rescue Stations in the form of guiding principles.

III.- Mine Rescue apparatus and equipment

1. Improving breathing apparatus for rescue workers

As regard to the question of improving breathing apparatus, the Working Party's initial idea was to suggest a prize competition for the development of a portable closed-circuit breathing apparatus, the required specification for this apparatus having already been laid down in the Second Report (2) (simplicity of use, reliability of operation, extension of the period of use, improvement of the breathing attachment and of the possibilities of communication, optimum adaptation to respiratory-physiological conditions).

After a further detailed examination of this question, the Working Party suggested to the Safety Commission that, before any prize competition were announced, the possibility should be examined of improving the respiratory-physiological conditions by means of a research contract.

The purpose of this research project is to further the development of more suitable devices, which might make the work of the men in the rescue teams less arduous - especially when they have to cover long distances.

To achieve this end, the extra physical strain imposed on the man wearing the breathing apparatus must be an absolute minimum. This extra strain is governed by various factors which must be investigated :

- the resistance to breathing offered by the device and the energy expended on breathing,
- the temperature and humidity of the inspired air,
- the CO_2 content of the inspired and expired air,
- the oxygen consumption and

(1) Appendix to Report, Annex X a.

(2) Second Report of the Mines Safety Commission, pp. 62/63.

- the weight of the device.

Ideally, the device should ensure that the man wearing it would have the least possible extra physical strain at the same time as maximum reliability of functioning of the apparatus.

The Working Party for "Mine Rescue Organization", in collaboration with experts and specialist doctors, worked out a research programme which was approved for execution by the Safety Commission in its Plenary Session of 27.11.1962, financial aid for the work being given by the High Authority.

Within the framework of this research work, the protective breathing devices used in the Community countries and in the United Kingdom having a service period of at least two hours were tested by selected persons performing various activities, each activity remaining unchanged, to study the devices in the light of the criteria set out above.

The values ascertained were compared with the reference values obtained from tests of the same devices carried out in the laboratory with "respiration" from an artificial lung. The purpose of making this comparison between the results obtained from tests with the two methods was to obtain values for the technical examination of the new designs in the laboratory.

Furthermore, to be in a position to propose improvements, it is necessary to determine the effect on the wearer of the apparatus of factors stemming from the design characteristics.

Finally, the question arises in this connection of the effect of unfavourable external (climatic) conditions on the rescue-team man wearing the breathing apparatus.

The Safety Commission therefore stressed the need to examine the following questions - of importance in connection with the use of these devices - at the same time as the tests envisaged were carried out :

- comparison of all devices under test in exercises under worsened climatic conditions,
- possible duration of service under worsened climatic conditions and
- effect of heat storage on the mental and physical capacities of the wearer.

The result of these tests should be to determine what improvements are required in the anti-gas breathing apparatus in use at the moment; in addition notes should be prepared which could be of use in preparing new designs.

Moreover, the regulations covering the manufacture and testing of anti-gas breathing apparatus in force at the moment could be modified as soon as the expected results of the research were available.

Three institutes were entrusted with carrying out this research project, because they seemed particularly suitable for the work by reason of their practical experience and of the test apparatus available to them for the purpose :

- The Physiological Institute of Liège University
- Coördinatie-Centrum Reddingswezen (the Coordination Centre for Mine Rescue) of the Campine coalfield at Hasselt
- The Main Mine Rescue Centre at Essen-Kray.

The research work is in hand.

2. Perfecting the CO-filter self-rescuer

Without losing sight of the main purpose, which is to develop a fully-protective self-rescuer (1), the Working Party considered it appropriate to give more attention to perfecting the CO-filter self-rescuer as an interim solution.

CO-filter self-rescuers are successfully used in Community countries and in the United Kingdom.

After an exchange of views regarding the development and use of these devices in the various countries it was agreed, on the basis of a synoptic survey of regulations already existing in this field to investigate those questions the answer to which could lay the foundation for formulating the requirements to be fulfilled by CO-filter self-rescuers, in particular with regard to design and physiological factors.

These questions include :

- technical requirements (design regulations)
- organization of use
- training in use
- maintenance and testing.

Work on these points is not yet completed.

3. Preparing a catalogue of equipment for special rescue operations

The examination of this problem was initiated in the light of experience obtained in two major incidents which took place outside the coal-mining industry.

Although the Annual Reports of the Working Party on "Mine Rescue Organization" do already contain a survey over a great deal of the equipment available in the Main Mine Rescue Stations, and although every member of this Working Party is kept continually informed of the fields of responsability of experts and of the available equipment in other Main Rescue Stations - all this by reason of the Recommendation regarding reciprocal assistance in rescue operations - the members of the Working Party nevertheless considered it necessary to study this question as a supplement to the Recommendation referred to above. Preparation of such a catalogue would provide information in the event of major incidents as to where to apply for a certain device, and which experts and operating teams could be called upon for special rescue operations.

This suggestion particularly concerns large apparatus, e.g. :

- for working through falls, the removal of fallen material and obstacles,
- large diameter boring apparatus with accessories and supporting material,
- slurry/water pumps,
- rescue cradles,
- ancillary apparatus e.g. :

  Listening apparatus,
  location apparatus,
  high-sensitivity microphones,
  borehole television devices,
  film cameras etc.

(1) Present Report, p. 45.

Examination of this question is in progress.

4. Frontier formalities and customs duties for mine safety equipment in the event of a major accident

With regard to the question of frontier formalities and customs duties for rescue equipment in the case of major incidents, the Mines Safety Commission agreed that it should not formulate a Recommendation, particularly as no difficulties had arisen hitherto when mine rescue equipment has been taken across frontiers, as far as present experience goes.

The Safety Commission would only consider this question again if a solution at ministerial level seemed to be called for.

C.- WINDING ROPES AND SHAFT GUIDES

I.- Use of accelerometers to test winding installations

With regard to the above question, on which the Safety Commission had already declared itself in the Second Report (1), an improved Report, the purpose of which is to set out in synoptic documentary form :

- the various accelerometers used in the Community countries and
- the advantages which can be expected from the use of these devices.

Investigation of the accelerometers in use in different countries has shown that these devices can give useful information, not only for checking shaft guides, but also in general for checking the operation of winding installations.

Moreover, some of the accelerometers listed in the Report have characteristics which make their use by the operators responsible for checking shafts much easier, e.g. :

- robustness and rapidity of setting-up,
- diagrams which can be read off immediately,
- purely mechanical functioning, or at most the use of small current supplies.

In the light of the state of development of these devices at that time, the Safety Commission abstained from formulating a Recommendation for use to be given to the officials responsible for routine checking of shafts but recommended continuation of the tests with accelerometers over a wide range.

The text of this Report appears as Annex V (2) and was issued to the Mines Inspectorate on 15.2.1962.

II.- Electromagnetic testing of winding ropes in use

With regard to the question of electromagnetic testing of winding ropes in use, the Second Report (3) states that the High Authority was giving financial support in this field to an experimental programme supported by the Safety Commission.

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(1) Second Report of the Mines Safety Commission, p. 67.

(2) Present Report, Annex V, p. 353

(3) Second Report of the Mines Safety Commission, p. 64.

The Working Party had in the first place given close attention to examining the existing literature on this problem and had taken note of the comparative tests carried out in the United Kingdom.

Following this, the Working Party had itself carried out tests in France, Belgium and Germany on winding ropes of various lays, using the test apparatus employed in those countries, and had carried out a comparative analysis of the results indicated in the diagrams so obtained.

It was only when the results were found to be unsatisfactory that the test programme already described in the Second Report was worked out and entrusted to the Rope-Testing Station of the Westfälische Berggewerkschaftskasse in Bochum.

In addition to this, the members of the Working Party and the experts associated with them had prepared a series of scientific studies on this problem and had placed them at the disposal of the Working Party.

In addition, the alternating current test device employed in South Africa and the United Kingdom had been tried out in practice in three Community countries and a special study had been made of the results of this trial.

The progress of this programme had been slowed down by reason of difficulties which arose in the selection of sample pieces of winding rope. The tests had, nevertheless been carried out in due and proper order, so that the final report was available for discussion by the Working Party for the first time in December 1964.

This final report makes it clear, inter alia, that for the first time new methods must be applied to assess the actual state of a rope - as revealed by later unravelling - since no reliable criteria were available for certain factors.

The Working Party had prepared a special statement with regard to the results obtained, containing broadly the following points :

a) The investigation of numerous diagrams recorded with the various electromagnetic test devices and the comparison of these results with the information obtained on unravelling the rope which had been tested makes it possible to conclude that the use of these devices allows of :

   - rapidly locating major faults in the rope,
   - determining the presence of broken wires in many cases and
   - checking the changes in the condition of a rope.

b) On the basis of the results of the research carried out under its guidance the Working Party noted that

   - it is not possible at the present time to identify the individual parameters of wear recorded on the diagram, such as corrosion, mechanical wear, crush points etc.,
   - it is not possible to give precise assessment of the loss loadbearing capacity of a rope by means of the diagrams recorded.

c) Consequently the Working Party expressed the view that electromagnetic testing is a useful auxiliary aid in assessing winding ropes, but that the interpretation of the diagrams is difficult in many cases.

d) From this it follows that :

   - the testing devices should be used only by experts, who must be aware of the limits and shortcomings of the method and also of the type and behaviour of the different designs of rope, so as to eliminate faulty assessments;

- electromagnetic testing cannot replace the normal conventional test processes such as external inspection, tapping with a hammer, twisting the rope open (when possible) or removal of a wire, but can only supplement them.

e) To sum up, the Working Party is of the opinion that the electromagnetic test method can make a contribution to increasing safety in man-riding when suitably used and in association with the conventional test methods.

The Mines Safety Commission accepted the Report (1) of the Working Party with the final report (2) of the Rope-Testing Station in its Plenary session of 20.7.1965 and decided not only to send it - as provided in the terms of reference - to representatives of the Governments and to the representatives of employers and workers on the Permanent Commission for further action, but also to distribute it widely to all bodies interested in this question (manufacturers, institutes, laboratories, scientific centres, technical universities, rope-testing stations etc.).

The Safety Commission hopes in this way to have stimulated further study of this problem.

The Reports were distributed on 15.10.65, together with a letter signed by the Chairman of the Safety Commission. The first edition, consisting of 350 copies in each of two languages, French and German, was rapidly exhausted, so that a second, even larger edition became necessary before the preparation of the Italian, Dutch and English versions.

The Working Party agreed to take a detailed interest in the further development of electromagnetic testing of winding ropes. The three testing institutes of the Association des Industriels de Belgique, Association des Industriels de France and the Westfälische Berggewerkschaftskasse in Bocum were invited to report to the Working Party within one year on special advances in the field of electromagnetic testing of winding ropes in their countries. Only after this will the Working Party decide to what extent the study of this problem should be continued.

III.- Outstanding questions

The experts proposed interim discussion of various problems from daily practical operations, e.g. :

- the utilization of various types of material for the manufacture of conveyances, suspension gear and cage safety devices, and also
- the preservation and maintenance of winding ropes by the use of special greases.

The Safety Commission has not yet decided whether the study of these problems should be accepted.

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(1) Present Report, Annex VI, p. 361.

(2) Appendix to this Report, Annex XI a.

D.- ELECTRIFICATION

I.- Underground electrical networks

1. Protecting underground electrical networks against fire and firedamp-explosion risks

Approval was given to the proposal to protect underground electrical networks to eliminate the danger of an electric shock, the wish was expressed in the Mines Safety Commission that the protection of electrical networks against the risk of fires or firedamp explosions should be included in the same investigation. At the time, this request had been met by the attached Report (1), to which there were also attached Recommendations and a commentary setting out the reasons for the various measures.

The Report was approved at the tenth session of the Mines Safety Commission on 27th and 28th April 1964 and was distributed on 20th May 1964 to the responsible organizations for further action.

The Report consists of the following three sections, which deal with the protection of underground electrical networks :

- against fire risk
- against the risk of ignition of firedamp
- in pits subject to sudden outbursts of gas.

All the Recommendations deal with alternating current. If direct-current circuits were introduced on a larger scale in the future, a similar Report on the measures to be recommended for direct current would be prepared.

A. In the first part, dealing with fire risk, three different groups of measures are recommended :

- As preventive measures : elimination of fire risk by excessive heating or by short-circuiting.
- As protective measures : selection of the risk installation, use of fire-resistant material or material which does not burn easily, removal of easily-ignited or combustible materials.
- As active measures : automatic protection of the networks against abnormal overloads, short-circuits and dangerous heatings.

Naturally, it is only by the simultaneous use of all three categories of protective measures that an adequate degree of protection of the underground electrical networks can be ensured.

B. In the second section, which deals with the risk of ignition of firedamp, simultaneous application of the three groups of measures is also recommended as follows :

- As preventive measures : avoidance of concentrations of firedamp at points where electrical equipment is located; investigation of the ventilation conditions whenever a new piece of equipment is being installed and before any installation is added to; investigation of any consequences of changes in operating conditions (in the working system) which may effect ventilation or gas emission;
- As protective measures : exclusive use of equipment certified by the responsible Inspectorate, inspection and maintenance of the apparatus and cables, clear instructions to the operators;

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(1) Present Report, Annex VII, p. 371

- Active measures : elimination of the risk of ignition where an explosive or combustible gas mixture is present. On this point, the Working Party expressed the view that robust and reliable devices were to be preferred to those which acted more quickly, but whose action was weak and whose construction was not robust enough.

B. In the third section, dealing with dangers connected with electrical networks in pits liable to sudden outbursts of gas, there is a series of additional measures which should be taken by reason of the greater scale of gas outbursts and of the difficulty of predicting them :

These additional measures are primarily directed towards three objectives :

- Restriction of the risk that electrical apparatus or current-carrying cables and leads may be hit by flying debris;
- elimination of the possibility that bodies of gas with a dangerous content of firedamp should be able to pass around current-bearing electrical equipment without the fact being known;
- strengthening of the normal electrical precautions in gassy pits not liable to sudden outbursts of gas.

2. Safety measures during actual operations to prevent accidents due to electrical shock, fire and firedamp explosions

The Safety Commission had declared its agreement that the Working Party on "Electrification" should begin to study the normal precautions employed in practical operations to ensure the safety and to eliminate accidents

- from electric shock
- from fire
- from firedamp explosions.

The main objective here is to examine the constructional features of electrical cables for underground use as well as the electrical and mechanical protection with which they are provided, the arrangement and composition of the earthing leads, the composition of the external sheathing, the mechanical reinforcement etc.

This work is considered complimentary to the work which has already led to proposals to the Safety Commission (compare point 1).

The great importance of the problem of electric cables is very clear, in view of the increasing electrification of modern mine workings.

3. Heat transmission through the core of an insulated and heat-shielded cable

The Working Party had to turn its attention to the transmission of heat through the core of an insulated, heat-shielded cable.

Among the Annexes (1) to this Report there is a note, with calculations, which shows that the heating of the conductors of an electric cable is virtually free from any fire risk, as long as the source of heat lies outside the cable. However, the problem is very different if the conductor itself is raised to a higher temperature as a result of the Joule effect, i.e. the heating of a conductor occurring when a conductor passes through it.

To give more force to the results of these calculations it should be pointed out that Silec (2) have carried out a test in which a cable was heated by

(1) Present Report, Annex IX, p. 104.

(2) Société Industrielle de Liaisons Electriques, Paris.

means of a soldering iron to 800° C. It was observed that the speed of spread of the heat was in fact only one-quarter of the calculated speed.

4. Effects of damp and the salt-paste method on the electrical networks underground

The Working Party on "Electrification" will in future have to consider all the problems which, as it were, form the logical consequence of or supplement to investigations carried out previously.

With regard to underground electrical networks, the study of which led to a Recommendation and to a supplementary study, further topical problems will arise. For instance, the Working Party is now obliged to examine those problems caused in underground electrical networks in wet pits or in pits where the salt-paste process is used to fix dust.

In its Plenary Session of 14th and 15th. 2.66 the Mines Safety Commission charged the Working Party with an investigation into these problems

II.- Flameproof switchgear for nominal voltages over 1100V

The Working Party on "Electrification" had presented a Report on these devices to the Safety Commission at its meeting of 16th October 1964 (1).

This fulfills the responsibility laid on the Working Party by the Safety Commission on 9th December 1958 to prepare a Recommendation to eliminate oil from underground transformers, condensers and other electrical equipment (2).

This responsability led to the decision to continue the "research into the development of low-oil or oil-less high-tension switchgear and high-tension relays having the characteristics necessary to ensure safe use in gassy pits".

The Working Party on "Electrification" had established - after detailed investigations of the problem and after journeys to Germany, Belgium, France, Italy, Netherlands and the United Kingdom to study the construction of these devices - that research into the development of low-oil or non-oil high-tension switchgear and relays with the characteristics required to provide safe use in gassy pits should be energetically pursued in the Community countries.

To provide a better survey of the matter the Working Party considered it advisable to prepare a list of the available apparatus ensuring reliable cut-off of electric current and to make a distinction between switches and relays.

A method of operation of these devices led the Working Party to classify them according to the type of cut-off (quenching of arc) :

- Quenching in oil (single-vessel oil-switch, low-oil power switch with separate chambers);
- quenching in water;
- quenching in a current of gas (switches with gas-jets, sulphur-hexafluoride switches);
- quenching in air. A distinction was made between two sub-groups of devices in this category of cut-off operation;
- switches which ensure cut-off with a low arc resistance : these types of switch cover pressure-gas switches, auto-compression switches and isolation switches with fusible-plug protection;
- switches which ensure cut-off with high arc resistance (air circuit-breakers in the normal sense).

(1) Present Report, Annex VIII, p. 385.

(2) First Report of the Mines Safety Commission, p. 4.

In all cases in which a suitable type of cut-off device exists for gassy pits, an indication has been given of the special features of the type of protection ("o", "d" or "e"), together with details of the practical behaviour and, if appropriate, of the field of application of the group of devices in question.

Following this, current trends in respect of the use of these devices in the mines of Community countries were discussed.

Finally, it was noted, in accordance with the wishes expressed by the Safety Commission, that there now exists a general trend in the case of switches for voltages above 1000 volts to reduce the quantity of oil used or to eliminate oil altogether.

It is, however, true that trials with the single-vessel oil switch (30 to 40 litres of oil) have also shown that this type of device has an exceptionally high degree of safety against firedamp and that the danger of ignition of the oil is low, if the right type of switch is chosen and correctly installed, i.e. in accordance with regulations.

In the case of relays for voltages above 1000 volts, which are frequently tripped, it is not possible to avoid the use of oil in the flameproof models. Quenching of the arc in air in fact produces ionisation and oxidation which reduce the effective reliability of the cut-off and in consequence also affect the functioning of the relay. These difficulties increase even more if the relay is called upon to function in gassy atmospheres.

Investigations into the functioning of switches and relays in gassy pits must therefore be continued, since oil is still used throughout in such conditions. The Safety Commission had, moreover, requested that this important question should be discussed again at regular intervals in view of the rapid development of switching technique. The above Report was issued to the responsible organizations on 17.11.1964.

III.- Investigation of accidents

1. Investigation of an accident caused by an electric shock

The Working Party was informed of the investigation of an accident due to electric shock which had involved a pit electrician in a colliery in the Dutch coalfield.

The network data were as follows : 500 volt DC, earthed neutral lead, limitation of fault current of some 30 amperes by a 99 ohm impedence; core-balance relay.

An electrician was instructed to reconnect a protective device against belt slip situated in the control switch-box of the conveyor. Half an hour previously the apparatus had been switched off to allow of repairs to the conveyor belt. The electrician was found dead, bent over the switch-box. The lid of the switch-box had fallen back on to the housing and had caused an earth connection. The core-balance relay had functioned and the circuit had been isolated.

The switch-box for the working comprised - in addition to the cable inlets and outlets on the supply side - an isolating and throwover switch with mechanical interlock, which should prevent removal of the lid of the main housing (containing the fusible plugs, a relay, terminals etc.) when the isolating switch was not in the "voltage cut-off" position.

Directly after the accident it was established that the isolating switch was found in the "operating" position; it must therefore be assumed that the electrician had forgotten to cut off the current.

However, on the other hand the interlocking had also failed, and in taking off the lid the electrician had also touched one of the terminals of the relay which was still under voltage (traces of bead formation). Since the lid was no longer in contact with the housing of the switch-box which was, in accordance with the regulations, connected to the earthing lead, but was still in the hands of the electrician, he was in direct contact with one phase of the system and was killed by an electric shock.

Repeated tests after the accident have shown that the interlock was no longer operating sufficiently reliably, perhaps as a result of wear. It is very clear from the investigation of this accident that interlocks do not provide one hundred per cent safety. In the case under discussion there was the complicating factor that the switch-box was installed in a very narrow niche.

The Working Party examined the question as to whether it was appropriate to provide pit electricians with checking apparatus, so that they could check whether the equipment was under voltage. Some members of the Working Party held the view that this measure would be a disadvantage, since there would then be a risk that the current would not be cut off before the housing was opened.

2. A heavy firedamp explosion occurred in the Aachen district by reason of a concentration of firedamp in a roadway where trolley locomotives were running. Sparks from the trolley wire had caused the ignition.

In connection with this accident the Mines Safety Commission had charged the Working Party on "Electrification" to investigate the safety measures applicable to trolley locomotives. The Safety Commission desired that these investigations should in particular cover the problem of how the electric sparks occurring during the movement of the locomotives could be reduced.

Naturally, increased safety can be achieved by other means from simply reducing the formation of sparks. However, as in other fields of mining operations, the principle was to be maintained that different types of safety measures should be taken simultaneously.

3. A pit accident in the United Kingdom gave rise to the charge laid upon the Working Party by the Safety Commission to investigate over-voltages produced in underground workings by lightning. It is a fact that lightning produces a steep voltage wave, which can produce very high over-voltages on the high-tension side. The low-tension current is then increased in the same proportion and this can lead to breaking down of the insulation. If such failure of the installation occurs in a gassy atmosphere, then it goes without saying that there is a risk of ignition.

This instruction to the Working Party was supplemented by the requirement to investigate the problem of scatter currents in mine workings. This old question has recently become acute again, by reason of the phenomena observed, particularly in the United Kingdom, in the electrification of railways on colliery sites.

4. In connection with a major pit accident in France in which the probable cause of the ignition was electrical, the Safety Commission gave the Working Party the following charge :

"investigation of safety measures to be taken in the case of necessary work on equipment still under voltage".

The first investigations of this accident had shown that a switch-box had been handled without the current being cut off previously, as the regulations provided.

5. In general, the Working Party is in the habit of examining the conditions in which the accidents or incidents of which they are informed had taken place, and to note where the causes were due to electrical installations.

While this Report was being prepared, the Working Party was studying the detailed circumstances of an accident in Belgium in which damage to a power cable was given as the cause of the ignition of a concentration of firedamp.

The Working Party also intends to discuss a major accident which had occurred in Wales. Here firedamp was ignited, because the face conveyor drive was under electric control precisely at the moment when, by chance, a concentration had been formed.

E.- COMBUSTIBLE DUSTS

1. As can be seen from Chapter III B, one of the conclusions drawn by the Mines Safety Commission on the basis of the various expert discussions of the pit catastrophe at Luisenthal was to prepare for and carry out the study of those problems which arise in consequence of the risks of explosions of firedamp and coal-dust.

2. After examining and approving a first draft programme of work, drawn up on the basis of suggestions from the various members, the Restricted Committee and the Mines Safety Commission expressed the wish that the problems set out in this draft should in the first place - before the establishment of a Working Party - be clearly defined in preliminary studies with regard to their scope, so as to make it possible to carry out a systematic investigation. During a meeting of experts, which emphasized the necessity for a study of this whole problem, it was insisted that this preliminary examination should be carried out with the proviso that in the first instance attention would be concentrated on a certain number of questions of direct and major practical importance, e.g. neutralizing coal-dust, the use of stone-dust barriers and the removal of coal-dust.

At this meeting the experts expressed the wish that after listing the problems at present being investigated in the various research institutes, and the results - or part results - attained from these studies, that there should also be prepared documents showing :

- comparison of the legislation existing in the various Community countries and in the United Kingdom;
- a list of the various causes which have given rise to ignition of firedamp or of coal-dust - from a given moment of time onwards;
- a precise summary of the whole of present knowledge in this field.

3. On the basis of these suggestions the Safety Commission decided to set up a Working Party with the following terms of reference :

"The Working Party shall investigate the problems arising in the coal-mining industry in connection with combustible dusts.

In the first instance, the Working Party shall investigate

- the mechanism of the ignition of dust and the propagation of the flame, and
- the factors which can affect the ignition of dust and the propagation of a coal-dust explosion, e.g.
  - the type of coal and/or the volatile content
  - the fineness of the coal

- the dust concentration
- the firedamp concentration
- the cause of ignition
- the effect of the manner of deposition
- the effect of humidity
- the local "geometry" in the roadway
- etc.

The Working Party is further responsible for studying the protective measures to be taken against ignition of dusts, in particular :

- the neutralization of dust (dust-suppression measures at the point of dust production, stone-dusting, spraying with water, binding of the dust by coatings of salts and coagulating pastes etc.),
- barriers (all the various types of barrier, their construction, their location etc.).

The Working Party shall be free to propose any research project which might, in its view, seem necessary to provide further information regarding the phenomena to be investigated and to increase safety in this connection.

The Restricted Committee is of the view that it is advisable from the practical point of view to begin this investigation by studying the neutralization of coal-dust and the use of stone-dust barriers.

The Working Party shall also have among its members representatives of mine managements, representatives of specialist research institutes in this field, practising engineers and miners' representatives.

In accordance with the normal practice, other experts may be co-opted for special technical problems, e.g. in connection with general chemistry or the combustion of coal.

4. In order to provide the members of this Working Party with precise and comparable information regarding present practice, a questionnaire was sent to the national mines inspectorates.

   This questionnaire called for the essential information which would give the Working Party a clear picture of the manner in which the problems of neutralizing the coal-dust and of employing stone-dust barriers are dealt with at this moment.

   The answers received were examined and compared, and in this way a very extensive compilation of information was available to the Working Party at its first session.

5. After a detailed exchange of views, representatives of three countries with the greatest experience in this field were entrusted with preparing a study of the coal-dust explosions which had occurred since 1950.

   Without going into the question of blame, this study sets out to provide the maximum useful information from the records of the various pit accidents; an attempt is made to pick out the typical cases, and to extend research into these beyond the three selected countries.

6. A further, smaller group - made up of Directors of Research Stations - was requested to compile the following information :

   - the proven results obtained from tests carried out up to the present,

- experiments at present being carried out,
- proposals for research projects to fill existing gaps in our knowledge.

This programme would be restricted to the most important points, so that first conclusions could be reached at the earliest possible moment.

7. This work is now under way. The lessons obtained therefrom will make it possible to continue the experts' discussion.

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While this Working Party for "Combustible dusts" was in process of formation, the secretariat - at the request of the Safety Commission - was occupied in collecting information which would make it possible to define more precisely the problems which arise in connection with firedamp.

The Safety Commission had expressed the wish that this work should begin with the compilation of a list giving details of all firedamp-measuring and firedamp-indicating apparatus, to provide a starting-point for investigation of the problems of measurement of firedamp and the conclusions to be drawn therefrom.

In accordance with this wish, work has begun on the compilation of documents regarding the various types of portable or fixed apparatus, remote-indicating methanometers and measuring apparatus for high gas concentrations, including all types at present in use as well as prototypes or proposed designs.

This preparatory work requires to be continued.

F.- HIGH AUTHORITY COMPETITION FOR IMPROVED MINE SAFETY EQUIPMENT

I.- First competition

The First Report (1) of the Mines Safety Commission indicated the reasons for organizing this competition.

On 9.2.1962, the competition was formally closed by the presentation of the prizes.

The five classes of apparatus covered by this competition were as follows :

1. Portable methanometer

This device was to replace the miner's flame lamp as a means of measuring firedamp concentration, and would, in particular, be issued to a large number of persons authorized to fire shots, for the measurement of firedamp concentration before shotfiring.

2. Portable firedamp-warning apparatus

This is a device for installation at the head of the face, in airways, in roadways being dismantled etc. It must give either an optical or an accoustic signal.

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(1) First Report of the Mines Safety Commission, p. 28.

3. Portable device giving warning of oxygen shortage

This device is intended to replace the miner's flame lamp as a means of giving warning of oxygen shortage, and for use, in particular by officials responsible for ventilation. If possible it should give an accoustic signal.

4. Carbon monoxide recording apparatus

The requirements to be met by this device are :

- to give timely warning of an incipient mine fire in pits with a high fire risk, and
- in the case of a fire already having a hold, to record the progress and extinction of the fire and to give the men in the pit warning of a dangerous concentration of carbon monoxide.

5. Fully-protective self-rescuer

This self-rescuer must provide complete protection against poisonous gases and against shortage of oxygen and thus make it possible for men to save themselves in the event of mine fires or explosions of firedamp or combustible dusts. This device, which completely eliminates the need for breathing the surrounding atmosphere, should be able to protect men against asphyxiation in cases where the CO-filter self-rescuer at present in use can offer no protection.

In each of the five groups of apparatus, the requirement was that the new devices should represent either completely new designs or considerable improvements over types already in service; in particular, the most important features called for were :

- the device should be as light as possible,
- should be simple to use,
- should be robust (proof against blows) and
- should be reasonable in price.

In view of the importance of this competition for the furtherance of safety in mines, participation was not restricted to Community countries.

The High Authority established a jury to examine the entries, consisting of experts from the coal-producing countries of the Community.

- All the devices entered for the competition (from the Federal Republic of Germany, France, the Netherlands and the United Kingdom) were tested for a period of six months in the laboratory as well as in underground service tests in two different countries - independently of one another.

On the basis of these trials the jury awarded the following prizes :

1. Portable methanometer

Two second prizes each of 10,000 European Monetary Agreement units of account for

a) Device submitted by the Ministry of Power, Safety in Mines Research Establishment, Sheffield,

   - This apparatus is characterized by a highly-developed measuring method, and the results of the trials justify it being considered a reliable apparatus for underground use.

b) The "Kuhbier 59" device, (Federal Republic of Germany).

- This device is based on a well-known measuring principle, which is very suitable for underground use. The small dimensions and low weight of the apparatus characterize its advance over other models in this field.

2. Portable firedamp-warning apparatus

One first prize of 35,000 European Monetary Agreement units of account for the device entered by Mines Safety Appliances, Glasgow.

- The modern design, the simple operation of the setting element and the measurement accuracy of this device justified this prize award.

3. Carbon monoxide recording apparatus

a) A first prize of 35,000 EMA units of account for the device entered by the Bergbauforschung G.m.b.H., Essen.

- This apparatus fulfilled all the requirements laid down in the competition regulations; it is particularly suitable for use because of its lightweight design, coupled with either continuous long-term monitoring of a ventilation current from a fixed station, or for short-term use at different points in firefighting operations - in both instances it is used in the same way. One particular advantage is that it gives quantitative indication of CO for concentrations as low as 0,005 % by volume.

b) Two second prizes each of 10,000 EMA units of account for

- the device entered by the Drägerwerk Company, Lübeck and
- the device entered by the National Coal Board, North Western Division, Central Laboratory, Manchester;
- both pieces of apparatus in general fulfilled almost all the competition requirements. Whereas the first apparatus is very suitable for use at fixed stations, the second is of lightweight construction and is better for short-term use at different positions.

4. Fully-protective self-rescuer

Two awards each of 10,000 EMA units of account for

a) the device entered by the firm Fenzy & Co., Montreuil (Seine) and

b) the device entered by the Auer-A.G., Berlin.

It was noted that the design of these pieces of apparatus had achieved further progress in the development of fully protective self-rescuers. The designers have come near to the solution required and have achieved very promising results with the principles they applied.

To sum up, the results obtained by the jury from the laboratory trials and the underground service trials with the prizewinning apparatus led to a satisfactory overall conclusion :

- the portable methanometer, the portable firedamp-warning apparatus, and the carbon monoxide recording apparatus are already capable of entering into service immediately after the end of the competition;
- the fully-protective self-rescuer devices only approximated to the conditions laid down; the experience gained during the tests will make it possible for them to be used successfully after some lapse of time.

II.- Second Competition

In the group covering the oxygen-shortage indicating devices the jury decided not to give a prize. However, bearing in mind the great importance for mine safety of the development of such an apparatus, they proposed to the High Authority to extend the competition for this group of apparatus and to offer the 70,000 EMA units of account not awarded as prizes in the first competition.

For the purposes of this second competition the jury drew up less rigorous conditions.

In addition, having regard to the difficulties encountered in developing a flameless oxygen-shortage indicator, they have left open the opportunity, if appropriate as a stop-gap solution, to award a prize to a flame apparatus, if the new apparatus offers essential advantages over the conventional flame lamps - although the ultimate objective is the development of a flameless apparatus as early as possible.

The conditions of this competition were published on 27.8.1962, after the High Authority had accepted the proposal (1).

The period for entry of these devices closed on 8.10.1964. At its first meeting on the 8th and 9th October 1964 the jury was able to examine the prototypes entered for the first time when they were personally demonstrated by the makers.

The jury's work is still under way.

The Mines Safety Commission has taken a very special interest in these activities which are so important for mine safety, and will be kept continuously informed of progress.

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(1) Bulletin of the European Community No. 77, 27.8.1962, p. 2160.

C H A P T E R   T W O

HUMAN FACTORS

The Mines Safety Commission had decided that the following four groups of problems should be studied (1) :

- The effects of working hours on safety, in particular under heavy working conditions or at unhealthy working points.
- Medical problems of safety policy.
- Psychological and sociological factors affecting safety.
- Effects of method of payment on safety.

Further details of the work undertaken in these fields is contained in the following survey.

A.- EFFECTS OF WORKING HOURS ON SAFETY, ESPECIALLY UNDER DIFFICULT OR UNHEALTHY CONDITIONS

The Safety Commission had issued the following mandate to the Working Party :

"Preliminary Remarks

a) The question here is what are the effects of the working time on safety, not the problems of the working time itself as such.

b) In studying this problem, the Working Party must take as its starting-point the basic principles laid down by the members of the Conference and subsequently by the Government. These principles should need no further amplification.

I.- Working time in the special cases which cause increased fatigue or danger

The Conference approved a general Recommendation on this subject. A suitable formulation must be found; in such cases the increased fatigue must be taken into account in laying down the length of the working period.

Starting from this basis, the Working Party responsible for these problems was able to vote to devote its attention to discussion of the following points :

1. In which cases must special measures be taken :
   - hot working-points,
   - wet working-points,
   - thin seams.

(1) Second Report of the Mines Safety Commission, p.

2. Hot working points

a) How is the effective temperature to be measured and to what degree must, e.g. the following factors be taken into account? :

- the temperature,
- the air velocity,
- the effects of radiation.

b) What limits should be laid down? i.e. :

- what is the threshold of effective temperature at which special measures should be put into force?
- should only one limit be laid down or should there be several stages, calling for different measures?

c) What measures to be taken? :

- shortening of the daily working period,
- shortening of the working time at the working-points in question or granting a rest day after a fixed interval.

3. Thin seams

a) In what instances is a seam to be considered as thin, and therefore calling for special measures? :

b) What special measures should be taken in such instances?

4. Wet working-points

a) When is a working-point to be considered as wet or moist, and when are special measures justified?

b) What measures should be taken in such a case?

II.- Effective Working time (including overtime)

The Conference approved of a Recommendation to restrict overtime to a minimum.

III.- Pauses during the shift, and other guiding principles for fixing working time (e.g. the time of day at which the shift starts, delayed working periods).

The Conference accepted a Recommendation regarding pauses during the working shift.

It might therefore be useful to see whether it was possible to lay down, inter alia, the length of these pauses, the number of pauses to be made and the time at which they would be taken during the working day.

It would also be advisable to investigate the effects of these pauses on safety, according to whether they were taken collectively by the men or individually.

It is not envisaged up to the present that further guiding principles for fixing working time should be issued. A particular subject for investigation would be the problem of adjusting work to the biological rhythm".

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As stated in the last Report (1), it was decided to study the subjects named in the working programme as appropriate for investigation; first in time and in importance was the subject of hot working-points.

Repeated discussions eventually led to complete agreement on the wording of the Recommendation regarding the laying down of climatic limit values, and of the explanatory notes to this Recommendation. The Recommendation refers only to underground working-points.

Medical experts collaborating in the appropriate investigations, subsidized by the High Authority, took part in these discussions.

The draft of the Recommendation and of the explanatory notes were referred to the Mines Safety Commission in its meeting of 18th July 1963 for assessment.

After a detailed discussion both documents were approved of (2).

Using as a basis a physiological index of climatic conditions, there was laid down a maximum climatic value above which it is forbidden (except in special cases) to work or remain at working-points.

Furthermore, there was laid down a range of climatic conditions within which working operations or mere presence there were allowed only with special precautions.

Finally, attention was drawn to the necessity of improving knowledge in this field so that the Recommendation could be improved accordingly.

The maximum climatic value was set at 32° eff A (basic scale), and the prescribed precautions must be taken in the range of climatic conditions between 32° eff A and 28° eff A (basic scale).

These precautionary measures include, inter alia, :

- special medical checks of the persons employed on this work appropriate to the special working conditions,
- selection of those persons who can, on medical grounds, be considered for work under these climatic conditions,
- restriction of the total time spent in such climatic conditions,
- application of a suitable method of payment to take account of the working conditions in such climatic circumstances.

The wording of this last point was agreed, after it had been decided to investigate in greater detail the problem of the method of payment for the climatic conditions ranging from 28° eff A to 32° eff A (basic scale), so as to obtain a clearer picture of the situation.

The measures listed in the Recommendation with regard to the protection of the men subjected to conditions falling within this climatic range represent the present state of knowledge regarding the medically-permissible work under such climatic conditions. Advances in medical knowledge in this field could therefore lead to changing or expanding the precautionary measures at some subsequent time.

It should be mentioned in this connection that the Mines Safety Commission has made it its business to recommend certain investigations, in an effort to contribute to extending present knowledge.

During the discussion of the "Recommendation on fixing climatic limits" attention was drawn to the problems of modifying the climate in the underground workings, especially in relation to the limits laid down in the Recommendation.

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(1) Second Report of the Mines Safety Commission, p. 87.

(2) Present Report, Annex IX, p. 397 and Annex XI, p. 411.

An application made by the "Gezamenlijke Steenkolenmijnen" in Limburg (Netherlands) for financial support of investigations into "the measurement of factors which affect the climate in underground workings" is intended to examine the problems of the factors which effect underground climate and if possible to find a solution.

The investigation had already progressed so far that the results were being put to practical use in Limburg (Netherlands).

However, there were still two elements of this problem which had to be examined in particular detail :

a) the oxidation of coal as an exothermic process underground

b) the mechanics of climatic conditions in workings with auxiliary ventilation.

Modification of the climate underground is undoubtedly of great importance to the safety and health of the men occupied there.

In addition, the investigation has economic and technical importance, particularly for managements who are faced with having to purchase air-cooling plant within the foreseeable future.

The Mines Safety Commission had unanimously approved these investigations and had supported the grant of financial aid by the High Authority in its meeting of 27th and 28th April, 1964.

Once the consultants of the High Authority had approved this application, the request for financial aid would be placed before the Consultative Committee, shortly before the end of the period of time covered by this Report.

B.- MEDICAL PROBLEMS OF A SAFETY POLICY

The terms of reference issued to the Working Party by the Mines Safety Commission run as follows :

"Preliminary remarks

a) The purpose is to examine the medical problems within the framework of a policy of safety in mines, i.e. fundamentally the following questions :

   - selection of the workmen on the basis of their state of health;
   - guiding the workmen into particular fields of work for which they are fitted on health grounds;
   - regular medical examinations to ensure that the workers are capable of carrying out the work on which they are employed;
   - conclusions drawn from the observations made by the medical service regarding the suitability or otherwise of a given workman for the work on which he is employed.

b) The principles accepted in this connection by the Conference and later by the Governments should be considered as final and do not therefore call for any further discussion.

I.- Description of medical services

- Number of doctors and assistants in relation to the number of workers;
- available medical equipment;
- working conditions;

- measures taken to create good relations between the medical service, the various operational departments, the workmen and their representatives;
- the contractual position of the doctors and the members of the medical service within the enterprise.

The practical success and the efforts made in this field, on the one hand by the whole branch of industrial medicine and on the other side by the colliery medical services is to a considerable extent dependent on particular details of practical execution which can only be worked out by a detailed, descriptive investigation.

This investigation would have to be extended to cover a limited number of colliery medical services, considered as those best able to provide usable information for the various Community countries. The Working Party could, if appropriate, prepare the skeleton for this descriptive investigation after having visited and inspected various medical services, and then after receiving the information, decide what conclusions should be drawn.

II.- <u>Measures to ensure specialization of the doctors wishing to serve or already serving as industrial doctors in the mining industry</u>

- Specialization during university studies;
- specialization after university studies;
- laws or regulations applicable in this field;
- measures taken in the coal-mining industry regardless of any legal provisions.

The specialization of doctors wishing to devote their activities to industrial medicine draws its special significance from the developments in this field and from the particular conditions under which industrial medicine is applied in the coal-mining industry, as well as by the essential knowledge of the surroundings and conditions of work.

III.- a) The adaptation of the workers who are no longer able to carry out their previous work for health reasons;

b) re-employment of these workers and those who have been shown by medical inspection to be no longer able to perform their previous work.

The measures in this field are of great importance, not only because it is essential for the worker to recognize the doctor's decision, but also because it is equally essential that he should willingly agree to be examined.

The Conference approved of the following Recommendation :

"Should it be found that there are grounds for not employing a man underground, he must be transferred to a suitable occupation, as far as possible within the framework of the same enterprise".

1. <u>Description of some of the measures already taken in the field of rehabilitation of workers who can no longer perform their previous tasks</u>

   This description could be carried out in the same way as was proposed in the case of the industrial medical services.

2. <u>Comparison of laws, regulations and contracts regarding the re-employment of workers who are unable - or no longer able - to perform their previous work and comparison of the measures to be taken to give force to these provisions</u>

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As stated in the previous Report (1), the Mines Safety Commission has approved of a first Recommendation in conformity with the terms of reference. This Recommendation covers :

- pre-entry medical examinations,
- special medical examinations,
- routine medical check-ups during work.

Investigations of the following problems have been begun :

- the type of organization for the industrial medical service,
- the operation of such a service and
- its composition".

In cooperation with the Department for "Industrial Medicine and Workers' Health" of the High Authority, inspection visits were paid to the following medical centres during the period covered by this Report :

"Centre de l'Association des Instituts de Médicine du Travail, de Traumatologie et de Réadaptation Professionnelle de l'Industrie et du Commerce" in Loverval;

"Centre de Traumatologie et de Réadaptation Fonctionnelle" of the "Caisse Commune de l'Industrie Charbonnière de Charleroi et de la Basse Sambre" in Montigny, and the Health and Social Service of the "Houillères du Bassin de Lorraine" in Merlebach and Forbach.

C.- PSYCHOLOGICAL AND SOCIOLOGICAL FACTORS IN SAFETY

The terms of reference laid down for the Working Party by the Safety Commission cover the following points :

"I.- Measures required to enable the workers :

- to recognize dangers
- to do their work in such a way that these dangers are avoided.

Various means of carrying out these measures to ensure that they have maximum effect.

For example, the following are emphasized in this connection :

a) specialization during industrial training of the worker in accordance with the job he is destined for : utilization of the worker at the working-point for which he was trained and maintaining him there;

b) steps to correct wrong or dangerous methods of working which have been observed in the case of certain workers or certain groups of workers : assistance in self-protection;

c) special instruction for the workers before beginning a job involving exceptional risks.

II.- Training officials with regard to safety

a) Encouraging attention to safety as a counterbalance to the desire to achieve production.

(1) Second Report of the Mines Safety Commission, p. 71.

b) Training with regard to practical questions raised by efforts to increase safety :

The training covers :

- correct preparation of accident reports
- assessment of information contained in these reports
- the search to establish causes of accidents
- the search for means to eliminate them
- familiarity with safety equipment.

III.- Measures necessary to ensure that all interested persons (workers, officials, management staff) are involved in the efforts to achieve maximum safety.

a) Suitable measures to encourage the competitive spirit between the different districts of the colliery or between pits (presentation of statistics or trends in the number of accidents per district, per working-point, per colliery, per group of workers with the same officials etc.).

b) Publicity campaigns in respect of mine safety :

- preparation
- measures to ensure their success
- assessment.

c) Activity of the Safety Committees and other similar bodies.

d) Activity of other bodies within the enterprise".

Terms of reference issued to the Working Party clearly lay down that it is necessary not only to work out proposals but also to study the most suitable means of putting these proposals into practice.

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The continuing discussion of the group of problems referred to in the previous Report (1) led to the approval of two documents on these points by the Mines Safety Commission at its meeting of 14th and 15th February 1966.

These two documents are entitled "Report on the Psychological and Sociological Factors affecting Safety" (2) and "Recommendation on the Psychological and Sociological Factors affecting Safety" (3).

The consultations which led to the preparation of the documents referred to had hitherto been concentrated in practice on three points which had formed the chapter headings in the Report (2), dealing in fact with points I and II in the terms of reference previously mentioned.

These are :

I. Measures to enable personnel to recognize dangers and work in such a way as to avoid them.

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(1) Second Report, p. 81.

(2) Present Report, Annex XII, p. 415.

(3) Present Report, Annex XIII, p. 425.

II. Training of safety supervisors and officials in safety problems; selection of such officials.

III. The effectiveness of psychotechnical tests.

Ad I. Measures to enable personnel to recognize dangers and work in such a way as to avoid them

In the first place attention must be drawn to :

A. Recognizing the dangers, it being necessary to distinguish three stages :

1. Before beginning activity all measures which can avoid any possible dangers should be carefully checked.
2. Safety conditions should be continually checked during working operations. In addition, certain specified reports must be prepared and data collected.
3. After the end of work, it is necessary to prepare a report which records a series of specifically-indicated items of information.

In connection with the recognition of the dangers, attention must also be paid to :

B. Informing all those involved of the dangers

Here a distinction is drawn between two phases in time which call for certain measures to be taken :

1. Before work is begun, it is advisable to have a discussion between representatives of the works management, the officials, members of the safety branch and the workmen themselves, to keep everybody informed, to discuss the working operations in detail and to settle upon the most suitable method of work; this method of work is to be made known to the workers involved by the most suitable means available.

2. While the work is being carried out, the management or the supervisory officials should emphasize the regulations and instructions which should be observed as often as necessary.

Any other announcements with regard to safety should be systematically brought to the notice of each person involved.

In addition, steps should be taken to ensure that information from any of the workers involved regarding dangerous situations arising in the course of work should be brought to the notice of the management officials.

C. Instruction on how to keep the work safe

This is primarily a question of occupational training.

In this connection, the reader is referred to a series of Recommendations which were formulated by the Conference on Safety in Coal Mines.

It is further emphasized that every underground must receive :

- a general training as an underground worker;
- a special training for the work assigned to him;
- any supplementary training in respect of special conditions at the working-point where he is employed.

Instruction regarding safety measures must be considered as an essential part of occupational training; consequently, this instruction must deal in particular with the safety problems which arise in connection with each of the methods.

There must be sufficient training staff to provide this instruction efficiently, and they must be provided with suitable means and have sufficient time to perform their task properly.

D. Supervision of working operations with regard to safety

The under-officials and supervisory officials are responsible for supervising not only production but also the observation of safety regulations. Their full responsibility in this respect must be clearly emphasized.

Apart from this supervision by under-officials and supervisory officials, it also seemed advisable to have recourse to further measures with the particular intention of ensuring that the work is carried out in a way which meets the safety regulations.

Ad II. Training of under-officials and supervisory officials in safety problems; selection of these officials

This chapter deals in particular with the following problems :

A. The basic principles for the occupational training of under-officials and supervisory officials.

B. Training the staff responsible for preparing the accident returns; the printed forms used for the purpose.

C. Appointment and promotion of the under-officials and supervisory officials.

General

To be able to get the best results with regard to safety factors in the occupational training of the under-officials and supervisory officials, it is of the utmost importance that continuity in the execution of their functions should be ensured.

Several stages must be distinguished in the hierarchy of these officials and the training programme must be adapted to the requirements of each of these separate stages.

Ad A. Basic principles of the occupational training of the under-officials and supervisory officials

1. The under-officials and supervisory officials must have a general training which corresponds to their tasks and responsibilities.

2. They must have an adequate knowledge of the special instructions for the various working teams whose operations they will have to supervise.

3. They must be able to draw the attention of the workers under their charge to the risks arising in their work, and to do this in a suitable manner, and instruct them how best they should do this work to avoid these risks.

4. They should further be trained in how to issue instructions in practice.

5. Special attention should be paid to the further training of all under-officials and supervisory officials.

6. They must prepare reports not only on the performance of their work, but also regarding accidents and any other incidents which call for mention.

The following points arise in this connection :

- the correct preparation of accident returns,
- the assessment of information given in these returns,

- the establishment of the cause of an accident,
- the search for means to avoid similar accidents.

Ad B. Training the staff responsible for preparing the accident returns; the printed forms used for the purpose

1. The accident returns must - taking into account all the human and technical factors involved - provide all necessary information, in particular in respect of :
   - the circumstances,
   - the consequences of the accident,
   - the causes,
   - the measures proposed to avoid similar accidents.
2. Each of these items of information must be capable of formulation as the answer to a clear and precise question.
3. The text of the form used for the return must make it clear what questions must be answered by the individual officials who have to collaborate in preparing the return.
4. Each of these persons should be informed regarding the meaning of the individual questions and on how to answer them correctly.
5. A systematic watch should be kept to ensure that the answers are complete, careful and accurate.
6. The accident returns should serve as the basis for the routine preparation of reports on experience in each district, each section or each working-point.

Ad C. Appointment and promotion of the under-officials and supervisory officials

It is a prerequisite condition for safety of work that there should be a sufficient number of officials having an adequate knowledge of the technical questions and of the problems of working safety, and who are also fully aware of their responsibility in these two fields. It is impossible to guarantee safe working underground if this is not the case.

In order to select persons who are most likely to fulfil these requirements, it is necessary to lay down beforehand the minimum requirements for appointment to one of these posts or for promotion within one of these fields of responsibility; moreover, such appointments or promotions should be made subject to assessment and reports on the efficiency of these persons.

The regulations governing the methods of selection or promotion of candidates for such posts for under-officials and supervisory officials differ from one member country to another.

Ad III. The effectiveness of psychotechnical tests

These tests fall into three groups :

A. Tests on appointment.

B. Before beginning particular categories of working activity.

C. Tests before promotion of a workman to the post of official.

Ad A. Tests on appointment

In this instance a relatively simple psychotechnical examination is sufficient to determine the general level of intelligence of the candidate, so that all those who do not reach a minimum level in this respect are excluded.

Ad B. Tests before beginning particular categories of working activity

In the case of workmen who are intended to be put on particular tasks which are associated with special responsibilities in regard to the safety of a group of men or which make particular requirements in respect of intelligence or character, it is advisable in every case to subject the candidate to a special psychotechnical examination which can determine whether he meets the requirements for this post.

The responsible Inspectorate - together with the representatives of the employers and of the workmen - should as soon as possible lay down precisely the categories of work for which these special examinations apply.

Ad C. Tests before promotion of a workman to the post of official

Workmen proposed for promotion to official should be subjected to a suitable psychotechnical examination.

D. Principles for carrying out the various examinations cited above

This section contains further details about the following points :

1. Determination of the criteria to be met by the candidates on appointment or, on subsequent.

2. Matters of which the psychologist must have full knowledge.

3. The period for which the psychologist's report is valid.

4. Comparison of the assessment by his immediate superior of the workman subjected to the psychotechnical examination with the report made by the psychologist.

5. The presentation of the assessments in a particular way which ensures a sufficiently high degree of objectivity.

x
x x

The Working Party will continue its activities on the basis of the terms of reference issued to it; the Working Party has been charged by the Mines Safety Commission with studying the following problems in detail :

a) The employment of foreign or young workers;

b) the general application of psychotechnical examinations, in particular to workmen engaged in activities which involve safety risks or which imply special responsibility.

D.- EFFECTS OF METHODS OF PAYMENT ON SAFETY

The Mines Safety Commission issued the following terms of reference to this Working Party :

"Introductory remarks

a) Only the effects of methods of payment on safety should be investigated, and not the methods of payment themselves.

b) The principles laid down by the Conference in this respect and subsequently approved by the Governments should be regarded as final and are not therefore to be discussed further.

I.- Various forms of application of methods of payment to piecework

(One-man, group or contract wage arrangements), which eliminate - or at least reduce - the risk that the worker may become neglectful as a result of these methods of payment.

Example : Separate calculation of piecework for working operations connected with safety in such a manner that the payment for this work is calculated and, if appropriate, paid to the worker independently of payment for production work.

II.- Effects of the payment on work in one-man piecework arrangements

a) Direct effect of this type of piecework payment on the payment of each miner;

b) effect of this method of payment on the team spirit.

III.- Effects on safety in piecework

a) in small groups;

b) in large groups.

IV.- Special measures with payment on a piecework basis

(In this connection it should be indicated, if appropriate, whether this is a one-man contract, a group or contract payment in large or small groups) :

a) with respect to the men working on piecework e.g. :

- exclusive employment of men with a specified level of training
- particular psychological effects on these men;

b) with respect to the officials responsible for these tasks : special training or information, in particular with regard to relations to the workmen".

To obtain a clear picture of the problems which arise in this field of work, a special questionnaire was prepared.

Several discussions took place after the replies to this questionnaire had been received. Representatives of the specialists departments of the High Authority were also invited to these discussions.

These discussions provide the opportunity to collect more detailed information about the methods of payment applied in the various Community countries and the problems associated therewith.

The discussions made it possible to achieve better comparability of the answers to the questionnaires, so that it was possible to prepare a comparative survey of the various answers received.

This comparative survey made it possible to prepare a report covering the points which were considered important having regard to the purpose of the work. The Recommendations were then brought together in draft in a document.

The two documents formed the basis of further discussions. By the end of the time covered by the present Report the discussions within the Working Party had terminated in the acceptance of the two documents.

Although the approval of the Mines Safety Commission has not yet been issued, it seems appropriate to give here a survey of the points made in the Report :

I. <u>Factors affecting the idea of the productivity wage and trends in this connection</u>

a) Reference is made to the formulation of the problem worked out during the Conference on Safety in Coal Mines.

b) Attention is drawn to the trends brought about by mechanisation.

c) Trends in respect of social matters are examined. Two Community countries have already introduced a new system of payment as a result of these trends.

II. <u>Basic principles</u>

This section deals successfully with :

a) Determination of productivity standards;

b) Factors in the assessment of productivity wages;

c) The productivity wage;

d) Unforeseen difficulties;

e) Results of working with a productivity wage;

f) Minimum and maximum ages for working on a productivity wage basis;

g) Transition from productivity wage to time-based wage;

h) The management and the officials appointed by them;

i) Determination of the salary scales for management and officials;

j) Arbitration.

It should be pointed out for completeness' sake that in the meantime a beginning has been made with investigations into the problem of the method of payment in the range of climatic conditions between 28° eff A and 32° eff A (basic scale); this investigation is based on the discussions already held on the effects of working time on safety work, in particular in respect of heavy work or work at unhealthy working points.

C H A P T E R   T H R E E

REPORT ON MINE ACCIDENTS

The system of reporting on accidents capable of giving valuable lessons continued - both in the Working Parties as also in the Safety Commission itself - in accordance with the agreement made at the Plenary session of 17.3.1958.

In accordance with this agreement, the Secretariat of the Mines Safety Commission is informed by telephone immediately after the occurrence in question regarding the circumstances which had led to the accident and the number of persons involved : thereafter the Secretariate is kept continually informed.

After this the first provisional report is tabled and discussed at the next meeting in date of the Safety Commission.

The written Final Report is then tabled after the official investigations have been completed; this report is also discussed at the next Plenary session in date, the safety Commission paying particular attention to the measures taken on a national level and the conclusions to be drawn therefrom.

Conclusions of this kind have already several times led the Safety Commission to charge its Working Parties with the investigation of particular problems arising in connection with a given accident.

The following survey clearly shows how much of the work of the Safety Commission is constituted by discussion of the most notable accidents and what importance is attached to this vital activity.

A.- SURVEY OF THE ACCIDENTS DISCUSSED IN THE REPORTING PERIOD

I.- Firedamp and coaldust explosions

1. Luisenthal Colliery (Saar), 7.2.1962 - 299 dead
2. Sachsen Colliery in Heessen (Ruhr), 9.3.1962 - 31 dead
3. Tower Colliery (Great Britain), 12.4.1962 - 9 dead
4. Adolf Colliery in Merkstein (Aachen), 14.12.1962 - 8 dead
5. Fenton Colliery (Great Britain), 13.6.1963 - 3 dead
6. No. 7 Colliery Liévin (France), 2.2.1965 - 21 dead
7. Cambrian Colliery (Great Britain), 17.5.1965 - 31 dead
8. Mont Cenis Colliery in Herne-Sodingen (Ruhr), 22.7.1965 - 9 dead
9. La Tronquié Colliery (France), 24.11.1965 - 12 dead

II.- Rock bursts

Sachsen Colliery in Heessen (Ruhr), 13.12.1962 - 6 dead

III.- Collapse of Mine Workings

1. Ste. Fontaine Colliery (France), 1.8.1961 - 7 dead
2. Ste. Marie in Lambusart Colliery (Belgium), 11.5.1962 - 6 dead
3. Colliery 13 of the Lens Group (France), 21.6.1962 - 6 dead

IV.- Man-winding accidents

1. Sachsen Pit in Heessen (Ruhr), 27.3.1964 - 10 dead
2. Pit 5-ter at Auchel (France), 17.6.1964 - 5 dead

V.- Inrushes of water

Bure-aux-Femmes Colliery (Belgium), 11.2.1961 - 11 dead

The catastrophe at Luisenthal led the Mines Safety Commission to call a special meeting to discuss its causes.

B.- CONCLUSIONS WITH REGARD TO MINE ACCIDENTS

I.- Conclusions from the disaster at Luisenthal

1. The Mines Inspectorate of the Saar drew from this disaster a series of conclusions the most important of which are reproduced below :

"1.- The method of ventilation air distribution and the way in which ventilation districts were delineated was newly laid down :

a) The main intake airstream should be split into as many independent parallel ventilation flows as possible, these being fed separately into the main return airstream. The term main airstreams covers those airstreams which pass through horizon roads in stone or through staple pits with at least one landing directly leading to a horizon, on the intake side up to the last split and on the return side from the first junction onwards. Airstreams flowing through a horizon road running in the seam and acting as a collecting airway are also considered as main airstreams, as long as this seam road is not at the same time serving as a gateroad.

b) Parallel airstreams ventilating one or more workings are considered as ventilation district airstreams and all the working-points ventilated by the same district airstream form together a ventilation district. Ventilation districts begin at the split or splits where the ventilation district airstream leaves the main intake airstream and terminate at the junction or junctions with the main return airstream. In one ventilation district there may be several splits on the intake side and several junctions on the return side, according to whether separate airstreams unite or a single airstream is split.

c) Ventilation district airstreams must be reliably separated from one another. They must not be arranged in series - not even after regeneration of the air - nor connected by diagonal airways (diagonal airstreams). Each ventilation district airstream must be shut off from neighbouring airstreams by its own separate barrier, in accordance with regulations regarding protection against explosions. This is particularly true in the case of the extraction of adjacent seams or in double-panel workings. If these conditions are not fulfilled, the workings constitute a single ventilation district.

d) Not more than 100 men can work in one ventilation district at the same time.

2.- Increased supervision of the ventilation conditions and of gas emission are imposed for all roadways within the zone of influence of workings. The term zone of influence is defined as a body of rock delineated in the roof and floor of the working by surfaces 50 m apart running parallel to the planned working and also by surfaces at rightangles to the stratification and parallel to the working, also 50 m apart.

3.- Minimum air-speeds are laid down for particular roads :

Gate-roads	0.5 m/s
Other roads within the zone of influence of the working	0.2 m/s
Roadways in a working in preparation	0.3 m/s
Stonedrifts with auxiliary ventilation	0.2 m/s
Rise drifts	0.4 m/s
Other seam roads with auxiliary ventilation	0.3 m/s

4.- A ventilation overman must be present for supervision of the ventilation for each shift. In addition, there must be available a special ventilation-measuring team, consisting of a ventilation overman and two ventilation men; they must examine the workings daily, especially within the zone of influence of the workings, with regard to the formation of layers of methane and they must, if appropriate, see that they are eliminated (by installing turbulence ducts, baffle plates or baffle cloths). In addition, a firedamp overman must be provided for pits with methane drainage systems.

5.- The stonedusting method is refined beyond its present state. Hitherto only one stonedust barrier was called for in each gate-road. Now a second stonedust barrier is required if the face is more than 175 m from the stonedust barrier. If gate-roads exceed a length of 500 m, new stonedust barriers must be installed every 500 m. It may be considered that this operation is facilitated by the fact that plastic troughs can be used in the construction of the stonedust barriers instead of planks, provided that these plastic troughs have been tested and given special permission.

6.- A new possibility is to replace stonedust barriers with water-trough barriers. The utilization of these barriers is left to the free choice of the pits. The only proviso is that only one of the two types of barrier should be used in the same pit. Only translucent plastic troughs of permitted design may be used for water-trough barriers. Water-supply lines must be provided in roadways where water-trough barriers are installed. Each main water-trough barrier must contain 200 l of water per sq.m of roadway cross-section, while secondary barriers must have 100 l of water per sq.m of roadway cross-section. In contrast to the regulations for stonedust barriers in gate-roads, water-trough barriers must be installed every 200 m. This decision was reached after tests at the Tremonia experimental gallery had shown that water-trough barriers in workings containing moist air can be more easily maintained in an effective condition than stonedust barriers.

7.- Finally, tests that have been made in the last three years at several pits with the salt-paste process to bind deposited coal dust. These tests were begun because dusting the workings with stonedust has been proved to be ineffective in eliminating the risks involved by the deposition of coal dust. The tests have shown that salt-paste binds the coal dust efficiently. However, the application of the paste in the gate-roads must be carried out over larger areas than had been envisaged in the preliminary tests. At the present moment preparations are being made in the Saar to introduce the salt-paste process as a fundamental measure. It is intended to apply the paste over the entire length of return gate-roads, while zones 150 m long will be coated with paste on the intake side of the workings, since the degree of dust deposition is considerably lower on the intake side, and in no case is it possible to bind the fine coal formed on the conveyors, not even if long zones are coated with paste."

2. The Safety Commission is to establish a new Working Party consisting of qualified experts (representatives of specialized research institutes, representatives of the Inspectorates, mining engineers, experts in chemistry and coal combustion); the Commission has charged the Working Party to investigate :

   - the whole group of problems associated with combustible dusts in coal mines

   and to deal in particular with the following problems :

   - mechanism of ignition of the dust and of the propagation of the flame, and
   - factors which can affect the ignition of the dust and the propagation of coal dust explosions, such as

     the type of coal and/or the volatile content
     the degree of fineness of the coal
     the concentration of dust
     the methane content
     the source of ignition
     the effect of the type of deposition of the dust
     the effect of moisture
     the geometry of the roadway etc.

   - and protective measures against dust ignition, in particular :
     - neutralization of the dust (suppression of the dust at the point of production) stonedusting, spraying, binding the dust by the application of salt and coagulating paste etc.)
     - barriers (barriers of various types - design - situation etc.).

   The Working Party will be able to suggest any research project which it may consider appropriate to increase knowledge with regard to the phenomena to be investigated and to further safety in this field.

   Work to this end is in progress.

II.- Noteworthy conclusions from other mine accidents

1. Measures to be taken to avoid explosions of firedamp and coal dust (accidents of 9.3.1962 at the Sachsen Colliery and of 14.12.1964 at the Adolf Colliery in Merkstein)

   The mining regulations issued by the Chief Mines Inspectorates in Dortmund and Bonn on 18.12.1964 contain the following provisions :

   - Airspeeds (paragraph 151)

     "a) The average airspeed may not fall below the values indicated hereunder in the largest free cross-section of the mine workings listed hereunder:

     workings ventilated by through-flowing airstreams

trolley-loco roads	1 m/s
gate-roads (top or bottom)	0.5 m/s
auxiliary roads including escape roads along the goaf	0.5 m/s
roadways ahead of the face	0.3 m/s

workings with auxiliary ventilation

advanced gate-roads	0.5 m/s
seam roads	0.5 m/s
rise drifts and staple pits headed upwards	0.5 m/s
dripping drifts and staple pits driven downwards	0.3 m/s
stonedrifts	0.2 m/s
large mining cavities	0.1 m/s (to be calculated)

b) The airspeed may not exceed 6 m/s. This does not hold for shafts reaching the surface, air channels and roadways not used for regular transport or travelling."

- Operation of ventilation installations (paragraph 143, section 3)

"Auxiliary ventilation installations can only be switched on again once it has been determined that this can be done without danger and that no risk is involved by the air being drawn off."

- Conducting waste air (paragraph 144, section 6)

"Waste air from workings with auxiliary ventilation must not be fed into trolley-loco roads."

2. Measures to be taken when installing new winding ropes (accident of 27.3.1964 at Sachsen Colliery)

- Travelling and working in shafts

"The only winding to be done in shafts when work is going on is that necessary for carrying out the work. Exceptions can be approved by the Inspectorate."

- Making clamp connections on winding ropes

"When ropes under load are being clamped, the clamp screws must be tightened several times so as to achieve the clamping force, because wire ropes tend by reason of their yield to undergo gradual deformation under the effects of a clamping force maintained for a longish time, and as a result the clamping force applied at the beginning is reduced."

3. Conditions to be observed when working in seams liable to rock bursts (accident of 13.12.1962 at Sachsen Colliery)

Further working in seam 24 of the Sachsen Colliery in Heessen - a seam subject to rock bursts - has been subjected by the Mines Inspectorate to the following conditions :

- "The working must be carried out in such a way that concentrations of stress are avoided;
- winning should be carried out over as broad a front as possible; short faces should be avoided;
- whenever possible caving should be practised instead of pneumatic stowing;
- a low rate of advance should be maintained;
- the coal face should be loosened up by intensive relaxation shotfiring;
- observations and measurements for the timely detection of the threat of a rock burst should be continued on a large scale."

In this connection the government of Land North-Rhine Westphalia have instituted a research project to determine the causes of rock bursts and possibilities of avoiding them, and they are contributing to the expense of this project.

4. <u>Conclusions drawn on the basis of roof-falls in faces (accident at Colliery 13 of the Lens Group 21.6.1962)</u>

- In winning operations in shortwall faces in the Nord and Pas-de-Calais Coalfield the following requirements must be met :

"1. The length of the face in a shortwall working must not exceed 20 m; diffusion ventilation is permissible only to a maximum length of 10 m.

2. The entry to the shortwall face must be in the main ventilation stream.

3. If the shortwall face is worked simultaneously with an adjoining main face from which it is independent, steps must be taken to avoid the shortwall face lying within the zone of influence of the advance abutment pressure brought about by the main face.

4. The supports must be set with particular care, especially at the entry to the face, at the buttock leading to the roadway and, where appropriate, along the line of a fault or at places where the roof is bulging.

   If the face is caved, the supports must be reinforced, to enable them to stand up to any overloading and to resist being overthrown : increased support density, additional rows of props or chocks along the breaking-off edge, stiffening with roof bars or lagging. One, or if necessary, several of these methods can be applied.

5. If the shortwall is a sub-level working and a pump has to be installed to remove the water which collects on the downside, the pump must be installed outside the shortwall face and the water drawn up via a rigid pipe fastened to the conveyor in the shortwall face.

6. Shotfiring in the coal face in the shortwall is forbidden; the only exception is for pulsed-infusion shotfiring which must however be previously approved by the Inspectorate.

7. In gassy seams :

   a) Shortwalls worked above a road must first be approved by the Inspectorate.

   b) The regulations require auxiliary ventilation with correctly-aligned ducting for all shortwall faces over 5 m in length. The air quantity measured at the extreme end of the shortwall must be roughly 1 m^3.

   c) The methane content of the air - measured twice per shift at the highest point in the face and recorded - must never exceed 1%.

   d) If this limit methane value is exceeded or if the auxiliary ventilation system stops, the shortwall face must be evacuated."

PART TWO

EXTENSION OF THE ACTIVITIES OF AND MEANS AVAILABLE TO THE MINES SAFETY COMMISSION

C H A P T E R O N E

EXTENSION OF ACTIVITIES

1. In the meeting of the Council of Ministers of 6th January 1964 the President of the High Authority proposed to the Governments to extend the field of activities of the Mines Safety Commission to those problems which have arisen on the one hand in the coal-mining industry in respect to the prevention of the diseases associated with mining work and on the other hand in the iron-ore mining industry in respect to accident risks and the diseases associated with mining work.

2. In actual fact the diseases associated with mining work represent a risk which is not less great than the risk of accidents.

3. In addition to this, the proposal to extend the activities of the Safety Commission was aimed at obtaining a proper proportion of the means at the disposal of the Community - these means not having been properly distributed hitherto - as a result of the restriction of the Safety Commission's activities to eliminating risks of danger in coal mines.

   Whereas in its efforts to eliminate accidents the Community has at its disposal - in addition to the means assigned to the High Authority to further research and investigations - the possibility of exchanges of practical experience in the Mines Safety Commission, in contrast to this, only the means of action of the High Authority were available in respect of the prevention of industrial diseases.

4. Although it was not the intention to modify the nature of the terms of reference of the Mines Safety Commission as defined by the Governments in 1957, the aim was at least to achieve an extension of its interests to a second risk. This could be done only by an unanimous decision of the Governments.

   In the meeting of the Council of Ministers of 11.3.1965 the representatives of the Governments modified the terms of reference (1) of the Mines Safety Commission with the declaration that henceforth the Commission was charged with "studying the trends in mine safety and the measures to avoid risks to health at the working place in coal mines".

   The other provisions of the terms of reference were modified accordingly.

5. As a preliminary to the entry into force of the decision taken by the Governments with regard to the extension of the responsibilities of the Mines Safety Commission to the preservation of health in coal mines, the responsible services of the High Authority are preparing proposals based on the experience gained in furthering research in this field and on the results obtained up to the time of writing.

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(1) Present Report, Annex XV, p. 437

C H A P T E R T W O

INCREASING AVAILABLE MEANS

1. The European Parliament had requested the Chairman of the Mines Safety Commission to participate in the negotiations - which it had instituted in the Community decision of 22.2.1962 with each of the Member Governments - to guarantee certain supervisory responsibilities to the Mines Safety Commission.

2. After these discussions at the political level, the representatives of the Governments in the Mines Safety Commission together examined the possible forms for the answer to be given to the negotiations instituted by the European Parliament.

3. The supervision of the application of the Mines Inspectorate regulations issued in the form of laws or regulations, and the investigation of blame in cases of offence or accident, are and remain the exclusive responsibility of the national authorities.

   The Governments will however continue to inform the High Authority in respect of the implementation of the tasks falling to them in virtue of the Treaty and to inform the Mines Safety Commission with respect to the implementation of its terms of reference.

4. A new system of passing information to the Safety Commission was envisaged.

5. With respect to information regarding mine accidents, the messages envisaged are intended to widen the method applying at present (1).

   At the request of the Chairman or the Secretary of the Mines Safety Commission to the responsible national authority or to the Government members of the Restricted Committee of the country in which the accident has occurred, official arrangements are to be made for members of the Secretariat to make the necessary visits to the colliery where the accident took place, in the presence of a representative of the appropriate national authority, to obtain information regarding the circumstances and effects of the accident.

   However, in order to allow for the time-dependent requirements posed by the mine accident, the time and form of the visit to the colliery in question must be fixed jointly by the appropriate national authority and the Secretariat or its representatives.

   Members of the Secretariat will then, by contact with the appropriate national services, inform themselves with regard to the collecting of information regarding the cause and effect of this accident, as well as the lessons to be drawn and the work carried out to check these reports.

6. At the request of the Chairman or the Secretary, members of the Secretariat are allowed - in the presence of a representative of the appropriate national authority - to visit mining companies and their underground installations in order to collect the information necessary for the Safety Commission to perform its task and in particular to inform themselves,

   a) How the Recommendations of the Conference and of the Mines Safety Commission - on the basis of the discussions of the Special Council of Ministers or in accordance with Section 4 of the terms of reference of the Mines Safety Commission - have been implemented, what problems have arisen as a result of this implementation and what effect they have had,

   b) How particular problems of safety arise in practice and how they have been solved.

   These are purely information operations; they shall not give rise to instructions nor to remarks to the representatives of the mining company nor to the local authorities.

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(1) First Report of the Mines Safety Commission p. 45.

7. Since there is therefore no intention of changing the terms of reference nor the constitution of the Mines Safety Commission, but only that of reinforcing its means of action to execute its task, the decisions to be taken do not require unanimity.

Five Governments have already answered the European Parliament on the basis of the principles worked out jointly, while the sixth Government was of the opinion that it could not accept any obligations of general scope in this field.

PART THREE

DEVELOPMENTS IN CONNECTION WITH MINE SAFETY; IMPLEMENTATION OR RECOMMENDATIONS OF THE CONFERENCE AND THE COMMISSION WITH REGARD TO SAFETY IN COAL MINES

C H A P T E R   O N E

DEVELOPMENTS IN CONNECTION WITH MINE SAFETY

In the First Report of the Safety Commission (1) it was stated that Italy has issued a new, enlarged set of mining regulations by decree of the President of the Republic dated 9.4.1959. This set of regulations was distributed at that time to all members of the Mines Safety Commission - additionally in French and German translation - for information.

Two further sets of regulations for coal mines have been issued in the period covered by the present Report.

A.- REGULATIONS REGARDING COAL MINES 18.12.1964 ISSUED BY LAND NORTH RHINE/WESTPHALIA

The Mines Inspectorate of the Land North Rhine/Westphalia issued a series of new mining regulations at the end of 1964, the most important of these being the mining regulations for coal mines issued on 18.12.1964.

The promulgation of a new set of mining regulations for coal mines had become necessary since the previous set of regulations, dating from 1935, was no longer suitable for use - in spite of having been revised in 1953 - because of the safety requirements resulting from the rapid advance in techniques and the concentration of workings, and moreover it did not take account of knowledge gained in recent years.

The new regulations differ from the old set even in their structure. They contain in the first part requirements applying to both surface and underground operations and are therefore of a general nature. The second part comprises additional regulations for underground mining operations and the third section contains similar regulations for surface operations. The fourth section contains the final provisions, e.g. regulations regarding the approval of exceptions, transitional decisions, prosecutions.

In applying this grouping, the regulations contained in the first section are of general application to other fields of mining, e.g. ore mining, quarrying of rock and earth, browncoal mining, and they therefore contain the appropriate regulations - also newly-issued - applicable to browncoal mining and mining of products other than coal. This was done in an effort to achieve some degree of unification of the presentation of the regulations.

It should be emphasized that the mining regulations for coal mines have for the first time been issued for the entire coal mining industry of Land North Rhine/ Westphalia in the same terms.

The new regulations contain - in particular with respect to underground operations - a series of important provisions which are either new or which differ from the previous regulations. The emphasis of the enlarged provisions for safety measures falls especially on the fields of protection of health, ventilation and the prevention or containment of explosions.

The Recommendations issued hitherto by the Conference on Safety in Coal Mines and by the Mines Safety Commission have been very largely taken into account in issuing this set of regulations.

These regulations were also made available to members of the Mines Safety Commission for information at the moment of publication.

(1) First Report, p. 115.

B.- REGULATIONS FOR MINES IN THE NETHERLANDS, 1964

The mining regulations of 1964 were issued by Royal Decree of 21.12.1964 and published in the "Staatsblad" on 30.12.1964. They came into force on 1.1.1965.

The "Committee for the Revision of the Mine Regulations" was entrusted with the preparatory work; this committee had been constituted by an order of the Minister of Economics of 12.12.1955. In 1956 the committee began work under the Chairmanship of the Inspecteur-Generaal der Mijnen. Representatives of the following bodies and groups sat on this committee: Ministry of Economics, Ministry for Social Problems and Public Health, Mines Inspectorate, "Raad van Beroep voor het Mijnwezen" (Consultative Council for Mining), companies carrying on the mining of bituminous coal and brown coal, producing petroleum and natural gas, and mining salt, as well as workers' organizations from the appropriate branches of industry.

The basis of the work, which was carried out by five sub-committees, was - in addition to the mining regulations of 1939 - the mining regulations for electrical equipment of 1947. The Recommendations of the Conference on Safety in Coal Mines of 1957 and the Recommendations subsequently formulated by the Mines Safety Commission were taken into account to a great extent.

It was found to be necessary to cancel a series of provisions of the mining regulations of 1939 which had in the meantime become outdated, and to include a variety of new provisions, not the least of the reasons for this being the rapid scientific and technical developments which made it necessary to modify the regulations to keep pace with the latest state of techniques. This fact was given full weight in the new mining regulations.

In addition to this it was found that the mining regulations of 1939 were, in particular, no longer suitable for application to the production of petroleum and natural gas which had grown considerably in the Netherlands in the period after the war. It was also necessary to allow for special considerations in formulating the regulations for brown coal mining.

To sum up, it may be pointed out that in spite of various difficulties which were encountered, it has been possible to draw up a set of regulations which are, by reason of their logical structure, suitable for application to all branches of mining. It is also worth remarking that the new regulations provide for the participation of professional associations when individual regulations are being prepared for issue, in contrast to the provisions of the 1939 regulations which only envisaged discussions with the appropriate mine managements.

A large number of copies of these mining regulations of 1964 were distributed, in German and French translation as well as in the Dutch version.

C.- BELGIAN MINE REGULATIONS ENTERING INTO FORCE DURING THE REPORTING PERIOD

Within the period covered by this report, a series of regulations have entered into force in Belgium, the most important being listed below:

- By Royal Decree of 19.9.1961, the regulation on mine ventilation and the classification of pits with regard to methane content;
- By Ministerial Decree of 11.9.1961, the regulation regarding the approval of conveyor belts;
- By Ministerial Decree of 26.6.1962, the regulation regarding the prevention of explosions of coal dust;
- By Royal Decree of 16.9.1965 and by Ministerial Decree of 27.9.1965;
- The regulations regarding dust suppression;
- By Royal Decrees of 13. and 16.4.1965 the regulations regarding measures to protect health.

It is also worthy of note that the following regulations are being revised:

- Regarding supports and strata control;
- Regarding electrical equipment;
- Regarding transport, and
- the regulation covering shafts and access routes.

C H A P T E R   T W O

IMPLEMENTATION OF CONFERENCE RECOMMENDATIONS WITH REGARD TO SAFETY IN COAL MINES

In the First and Second Reports of the Mines Safety Commission, the reader was given a survey not only of the arrangement of the Recommendations of the Conference on Safety in Coal Mines set up in 1957 by decision of the Governments represented in the Special Council of Ministers, but also of the state at 1.11.1958 and 31.12.1960 of the implementation of all these Recommendations and of the measures taken in detail.

In the Second Report the Mines Safety Commission stated that in subsequent reports it would no longer - as hitherto - report on the situation in respect of all the Conference Recommendations, but only with regard to those which had not been implemented by a particular arbitrary date, either in the form of laws or regulations or de facto.

The last Report contained for the first time, in addition to the tabular survey of all Recommendations, the situation - in each country and under keyword headings - with regard to those recommendations for which

1. The possibility of issuing new regulations was under examination (E),
2. Uncertainty still obtained with regard to the steps to be taken (?) and
3. Any application of the regulations to the Conference Recommendations was rejected (A),

in order to make it possible for the reader to gather the content of these Recommendations, without it being necessary to refer to the bulky Report on the Conference on Safety in Coal Mines.

Consequently, no account is taken of those Recommendations which are classified as follows by the appropriate authorities:

4. C = National regulations already comply with Conference Recommendations,
5. C' = The Recommendations are not embodied in the regulations, but are implemented de facto,
6. NRC = New regulations in conformity have been prepared and issued,
7. NRP = New regulations in conformity are in course of preparation.

It should however be pointed out that the process of applying a series of Conference Recommendations by means of laws or regulations is in hand in various countries (NRP), but that in various cases no final publication of regulations has yet taken place. Further details on this point will be given below, showing the latest situation for the various countries in question.

In addition, the answers received from various countries as a preliminary to preparing this Report have shown that there are various points which the Mines Safety Commission is asked to examine again (EOP).

This type of presentation has been welcomed by all those involved and is continued in the following part of the Report, in accordance with the wish expressed by the Mines Safety Commission with regard to the Conference Recommendations.

However, before going into details, it is necessary to recall that the Conference on Safety in Coal Mines formulated a total of 280 Recommendations, which the Mines Inspectorate had to consider with a view to applying them to existing regulations or to implementing them by issuing new ones, and that infrequently special problems had to be solved and a variety of difficulties cleared up.

Looking at the achievements in this light, the Mines Safety Commission noted with satisfaction at its meeting of 19 and 20.7.1965 that most of the Governments had already implemented by far the largest number of these Recommendations, 155 of which dealt with technical problems, 51 with safety provisions, supervision of safety and the participation of the workers in safety supervision, and 74 with human factors.

The situation at 1.1.1966 is given below, together with the terms of those Conference Recommendations which still call for action under points 1 to 3 listed above, or which are no longer being considered for implementation.

A. TECHNICAL RECOMMENDATIONS

a) Federal Republic of Germany (North Rhine/Westphalia)

With only two exceptions, all Technical Recommendations have been implemented.

The responsible authority has rejected (A) the Recommendation A-5, page 35 of the Conference Report, and Recommendation A - 14 - M - b, page 81 has been referred to the Mines Safety Commission for further examination (EOP), as had been suggested by the Mines Inspectorates of the other countries.

This refers in detail to the following text:

1) A - 5, page 35 Conference Report

Clearing-out of compressed-air mains

"The clearing-out of compressed-air mains in gassy mines should only be undertaken provided:

- The compressed-air valve is opened very gradually.
- Every effort is to be made not to direct the air jet towards those points where firedamp is most likely to be present.
- It has been ascertained that there is no accumulation of firedamp in the area immediately in front of the end of the air pipe".

2) A - 14 - M - b, page 81 Conference Report

Internal-combustion engines below ground

"Where there is a danger of sudden accumulations of firedamp in haulage roads used by locomotives, the latter must be equipped with devices enabling the air inlet to be shut off instantaneously".

b) Federal Republic of Germany (Saar)

In a total of twelve cases the Technical Recommendations have not yet been implemented:

- Three Recommendations are still being studied with regard to the possibility of preparing new regulations (E), this study referring in one case to only one part of the Recommendation, the other part being already embodied in the existing regulations (CE).

1) B - 3 - 3 b, page 59 Conference Report

Prevention of fires in shafts

"In new shafts, and where possible in those being overhauled, it is advisable to use, for preference, fire-resisting guides, or at least non-inflammable grease".

2) A - 20 - M, para. 2, page 76 Conference Report

Locomotive haulage

"New locomotives and other vehicles should as far as possible be fitted with devices which will ensure that they can be set and kept in motion only when the driver is at his post".

3) A - 5 - SC, page 19 Conference Report

Face support

"In mechanized coal-getting, the cylinders used for shifting the conveyor should be staked not against the face support but against either the roof, or chocks, or any element not forming part of the regular face support."

- In five cases the responsible Inspectorate consider it appropriate to refer the Recommendations to the Mines Safety Commission for further checking (EOP):

4) A - 4 - SC, pages 19/20 Conference Report

Face support

"At the faces, the props, their bearing surface, density, etc., must be adapted to the weight to be supported and the ultimate breaking strength of the rock.

The aim should be to make increasing use in future of steel props of permanently uniform load-bearing capacity, evolving the minimum of dependence on the care or otherwise with which they are placed in position by the propsetter."

5) B - 6b, page 49 Conference Report (1)

Stone-dust barriers

"The maximum number of men to be employed in anyone "isolated section" during the main shift must be fixed by the competent authority."

6) B - 3 - 2 d, page 54 Conference Report (1)

Prevention of fires in shafts

"In all shafts, and particularly in downcast shafts, it is necessary to replace all inflammable liquid in piping and in hydraulic equipment by non-inflammable liquid."

7) B - 6 - b, page 58, last sentence, Conference Report

Places where inflammable materials accumulate

"If such places are not under constant supervision, fire detectors and automatic fire-extinguishing apparatus must be installed."

8) A - 14 - M - b, page 73

Internal-combustion engines below ground

(For text see above under I a) 2)

- In four cases the responsible authority has rejected any implementation (A), this action applying to three of the Recommendations only in part (CA):

9) B - 5b, page 48, Conference Report

General neutralization

"The prescribed minimum percentage of incombustible matter in dust must be fixed in proportion to the amount of firedamp present."

(1) Roof problems are at the present moment being reexamined by the responsible Working Parties of the Mines Safety Commission.

10 - 11) B - 2a and B - 2b, pages 52/53, Conference Report

Detection of underground combustion

"In pits and districts liable to spontaneous combustion, the carbon monoxide content should be regularly checked in order to detect any incipient heatings in time.

To this end, it should be the practice, in the return airway in each working where coal-getting or drawing-off is going on:

a) To measure the carbon-monoxide content daily with an approved detector which will indicate the CO content from 0.001 % upwards, or recorded with an approved CO-recording apparatus, if available, unless another method is used which would detect incipient heating equally effectively;

b) To make a thorough analysis of the air and calculate the CO/O_2 ratio at least once a week."

12) A - 7 - E, second sentence, last part of sentence, page 63, Conference Report

Restriction of the use of combustible oils

".... effective precautions should be taken to prevent any risk of fire from leakages. Such precautions should include .... automatic indicators showing the temperature of the oil and the emission of decomposed gases, as well as fire-curtains and fire-extinguishers."

c) Belgium

There are still 13 Recommendations which have not yet been fully checked (E); there is still uncertainty as to the steps to be taken in respect of 2 Recommendations (?); in one case implementation has been rejected (A) and 1 Recommendation has been referred back to the Safety Commission for check and amplification (EOP). In a further 57 cases work on the preparation of new regulations is already in hand (NRP), but is not yet finished.

- The following Recommendations are still being examined:

1 - 6) A - 1 - M - a to e, page 67, Conference Report

Signalling systems in shafts

"a) In all main shafts, and in all staple-pits where man-riding is carried on regularly on a considerable scale, electric signalling devices must be installed. As far as possible, shafts where man-riding is not carried on regularly should also be provided with electric signalling devices.

b) The electric signalling installations should be so designed that it is impossible to signal at the same time from two or more landings.

c) Where new electric signalling systems are to be installed (particularly those with relays), it is recommended that they should be provided with a continuously-recording insulation-measuring instrument, or in simpler instances with a continuously-operating indicating instrument for the supervision of insulation.

d) Electric signalling systems connected with intermediate landings should be provided with an emergency signalling device enabling an emergency signal to be transmitted to the winding engineman from any landing at any time.

e) Existing electric and mechanical signalling systems should as far as possible be supplemented by telephone installations."

7 - 8) A - 2 - M, paras. 1 and 2, pages 68/9, Conference Report

"Where two or more decks at a single landing are used simultaneously in man-winding, the signals of the main loading point should be automatically locked until all the other decks have signalled that they are ready.

This does not apply to synchronized signalling systems. Where these are used, the signallers at each deck must be included in the system."

9) A - 5 -M, page 70, Conference Report

Shaft-sinking

"In shaft-sinking operations, the guides for the kibbles should reach down at least as far as 50 metres above the bottom of the shaft.

If a ladderway is not installed at the same time from the start of the sinking operations, an emergency winding installation should be provided, operated by means independent of the power used for the main winding engine."

10) A - 6 - M, page 70, Conference Report

Cables

"In staple-pits and upcast shafts with a high relative moisture content in the atmosphere, and in wet shafts, new ropes with galvanized wires should be used, unless galvanization is undesirable owing to particularly corrosive elements in the air or water.

Winding ropes attached to drums or reels may be lubricated instead of galvanized."

11) A - 7 - M, page 70, Conference Report

"Fixed working platforms in shafts must be assessed for maximum load plus an adequate safety margin before they are installed. One assessment for each type is sufficient.

The material employed for constructing platforms, especially timber, should be examined periodically for quality and safety."

12) B - 29 - M, pages 80/81, Conference Report

Checking guide equipment

"In ventilation shafts which are showing the effects of continuous mining operations, or in which there is excessive wear and tear on the guide-rods, the guides should be examined at regular intervals with an appropriate testing apparatus."

13) B - 30 - M, page 81, Conference Report

"The use below ground of all inflammable oils, with the exception of lubricants and diesel fuel, should be discontinued as far as possible, even for mechanical purposes, such as the operation of hydraulic equipment, couplings, tub-decking plant, props, etc."

14) A - 14 - M - b, page 73, Conference Report

Internal-combustion engines below ground

(For text see under I a) 2)

There is still uncertainty about the following Recommendations

15) B - 9 - S, page 17, Conference Report

Payment for shotfirers

"The method of payment for shotfirers and acting shotfirers should be such as to give these men a special incentive to see that shotfiring is carried out in accordance with the regulations. Their pay should be commensurate with their position of responsibility."

16) A - 3 - M, page 60, Conference Report

Man-riding installations in shafts

"As regards existing electrical signalling installations, it is recommended that in all ventilation shafts where man-riding is carried on regularly on a considerable scale there should be an interlocking device connected with the winding engine, which will lock the winding brake during man-riding, so long as anyone of the shaft gates is left open."

- No new regulations are to be issued in the following instance:

17) B - 1 - 3, pages 51/52, Conference Report

Prevention of underground combustion

"In the preparation and implementation of working plans relating to pits or districts subject to spontaneous combustion, care should be taken:

I.3. To employ, for preference, retreated working where this does not involve danger from firedamp."

- The 57 Recommendations already referred to above, in respect of which new regulations are being prepared although the work is not yet finished, are primarily concerned with the following fields:

Electrification, continuous conveyors, internal-combustion engines underground, travelling, locomotive haulage and man-riding.

d) France

One Recommendation is being examined with a view to preparing new regulations (E), one Recommendation has been rejected (A) and one Recommendation referred back to the Safety Commission (EOP). New regulations are being prepared in respect of 27 Recommendations, but the work is not yet finished (NRP).

- Examination of the following Recommendation is not yet finished:

1) General working plans

"It is necessary, in the interests of safety, that the coal owner should draw up general long-term and short-term plans of operations, and forward these in advance to the competent authority. These plans should incorporate all such details as may be necessary to enable the authority to judge their implications concerning safety.

Any amendments of importance should be intimated in good time to the same authority. The latter must be entitled, where necessary, to enter objections to the plans within a suitable time-limit."

- The following Recommendation will not be implemented:

2) B - 28 - M, page 80, Conference Report

Man-riding in staple-pits

"All staple-pits should if possible be provided with man-riding apparatus, and man-riding in such pits should be authorized."

- The following Recommendation has been referred back to the Safety Commission:

3) A - 14 - M - b, page 73, Conference Report

Internal-combustion engines underground

(For text see above under I a) 2) .

- The 27 Recommendations in respect of which new regulations are being prepared although the work is not yet finished are primarily concerned with problems of preventing fires in shafts and mine workings, electrification and shaft-winding.

e) Italy

9 Recommendations are still being examined with a view to preparing new regulations (E), no decision has been taken (?) in respect of 5 Recommendations, in a further 5 cases the Recommendations have been rejected (A) and one Recommendation has been referred back to the Safety Commission (EOP).

- Recommendations still being examined:

1) A - 8 - E, para. 1, page 64, Conference Report

Restriction of use of combustible oils

"Oil-filled electrical equipment should not be used either on coal faces or in their immediate vicinity. In roadways this type of equipment should always be fixed."

2 - 3) A - 15 - M & 16 - M, pages 73/4, Conference Report

Travelling below ground

"Loading points and similar places where the travelling road crosses the track and where mine-cars are constantly being set up and/or moved about during operations, and points in conveyor roads where it is necessary to cross the belt, should be bridged over to ensure safe crossing.

Every effort should be made to ensure that a travelling road is at all times left along the face."

4 - 9) A - 17 - M to A - 20 - M, pages 74, 75 & 76, Conference Report

Locomotive haulage

17 - M: "New locomotives and other self-propelled vehicles must have covered cabs, and must be so constructed that the driver has a sufficient view of the track from his seat, in whichever direction he is travelling, without leaning out of the cab.

Locomotives already in use must be converted to conform with these requirements. Those which cannot be so converted must be either withdrawn from service within a maximum time-limit to be laid down by the competent authority, or used only on those roadways which afford sufficient clearance above and on either side to make accidents unlikely."

18 - M:

"a) All locomotives must be provided with side-friction brakes, which should be powerful enough to ensure maximum braking efficiency on the part of the brake blocks. Where the mine-cars are also fitted with brakes, the braking-power of the locomotive may be reduced in proportion.

b) The maximum load to be hauled by anyone locomotive should be fixed in relation to the maximum speed and to the average gradient of the road, in such a manner that the braking distance with a mean coefficient of friction of 0.17 does not exceed a given length.

For main-road locomotives travelling at 4 metres per second, a braking distance of 80 metres can as a rule be considered sufficient.

c) All locomotives, with the exception of small low-speed types, must be equipped for travel in either direction with electric headlights which can be dipped from the driver's seat.

The headlights must ensure adequate illumination over the entire braking distance."

19 - M: "All locomotives should also be fitted with sandboxes which will operate when travelling in either direction."

20 - M: "All locomotives and other self-propelled vehicles should be fitted with devices which will prevent their being set in motion by any unauthorized person. New locomotives and other vehicles should as far as possible be fitted with devices which will ensure that they can be set and kept in motion only when the driver is at his post."

- In the following cases there is still uncertainty with respect to the preparation of new regulations:

10) B - 9 - S, page 17, Conference Report

Payment of shotfirers

(For text see under I c) 15)

11) A - 4 SC, pages 19/20, Conference Report

Face supports

(For text see under I b) 4)

12) A - 14 - SC, pages 22/3, Conference Report

Gate-roads

"In gate-roads the supports should resist the general lowering of the rocks only to the point where it is still possible for the whole of the strata to lower together with the surrounding rocks, without bed separation. This does not, however, apply to steep and semi-steep formations, where the roof and floor strata have a tendency to slide, and rigid supports are, therefore, necessary."

13) A - 2 - M, para. 2, page 69, Conference Report

Signalling systems in shafts

"With synchronized signalling systems, the signals at each deck must be included in the system."

14) A - 21 - M, page 76, Conference Report

Locomotive haulage

"Points and ventilation doors in busy roadways should be so constructed as to make it possible to operate them from the locomotive.

The ventilation doors should furthermore be fitted with a contrivance which will give warning of the approach of the locomotive before they open."

- The responsible authority has rejected the following Recommendation:

15) A - 4, page 31, Conference Report

Compressed-air ejectors

"Compressed air-ejectors in use underground must be properly placed in appropriate tubing of sufficient length to ensure that the distance between the ejector and the discharge point is not less than the specified minimum, to be fixed by the competent authority. The whole apparatus must be properly earthed."

16) <u>B - 4, page 36, Conference Report</u>

<u>Firedamp drainage</u>

"The systematic drainage of firedamp from the adjacent strata should be carried out in all mines where the firedamp content exceeds the permitted maximum with normal methods of ventilation. A network of special piping should be installed in such pits, but all necessary equipment should be available to ensure that firedamp drainage may be undertaken at any time."

17) <u>B - 1 - 3, page 52, Conference Report</u>

<u>Prevention of underground combustion</u>

(For text see above I c) 17)

18 - 19) <u>B - 3d and e, page 54, Conference Report</u>

<u>Prevention of fires in shafts</u>

"In new shafts, and where possible in those being overhauled, it is advisable:

d) to site the gas-drainage pipes in the upcast shafts, if at all possible;

e) to ensure that electric cables, compressed-air mains and gas-drainage pipes are kept well apart."

- The following Recommendation has been referred back to the Safety Commission for check and amplification:

20) <u>A - 14 - M - b, page 73, Conference Report</u>

<u>Internal-combustion engines underground</u>

(For text see above under I a) 2)

f) <u>Netherlands</u>

In respect of the total 155 technical Recommendations the situation is as follows:

- The checking of one Recommendation has not yet been finished (E).

1) <u>A - 20 - M, para.2, page 76, Conference Report</u>

<u>Locomotive haulage</u>

"New locomotives and other vehicles should as far as possible be fitted with devices which will ensure that they can be set and kept in motion only when the driver is at his post."

- In a further instance the Recommendation has been referred back to the Safety Commission (EOP).

2) <u>A - 14 - M - b, page 73, Conference Report</u>

<u>Internal-combustion engines below ground</u>

(For text see above under I a) 2)

- In a further 5 cases new regulations are being prepared, but the work is not yet finished. These Recommendations deal with electrification and with the use of combustible oils in mechanical apparatus.

B. RECOMMENDATIONS REGARDING SAFETY REGULATION - SAFETY SUPERVISION - WORKERS' PART IN INSPECTION

a) Federal Republic of Germany (North Rhine/Westphalia)

Of the total number of 51 Recommendations in this field, all have been applied except three which were not accepted.

- No application will be made of the following Recommendations:

1) I - 2nd paragraph, page 85, Conference Report

Safety Departments in enterprises - exchange of information

"It is recommended that exchanges in information be organized among offices of the Safety Department of the different collieries. It is further considered that the Mines Inspectorate should take part in such exchanges from time to time.

Such exchanges should be arranged not only at pit, coal-field, or national level, but at Community level."

- While the Recommendation embodied in the first paragraph above is already implemented in North Rhine/Westphalia, the Recommendation in the second paragraph will not be implemented, on the grounds that this cannot be laid down by the Inspectorate.

2) A - 2 - 2nd paragraph, pages 91/2

Revision of the status of the entire Mines Inspectorate staff

"The Conference is of the unanimous opinion that a revision of the status of the entire Mines Inspectorate staff is imperative. It is desirable that the Governments concerned should see to it that the standing of the personnel of the Mines Inspectorate is such as to ensure satisfactory recruitment and retention of staff.

In return, it is felt that the Government may reasonably require them to work in the Inspectorate for a stated minimum period, and to engage full-time in their inspection duties."

- The Recommendation embodied in the second paragraph is rejected.

3) B, page 97, Conference Report

Disciplinary action in the event of breaches in safety regulations

"The Conference holds the view that at the same time, disciplinary action, although indispensable, is not the most effective method of improving safety, and a study of the causes of accidents shows the human factor to be all-important.

Greater safety can be attained primarily through a detailed study of working methods, through proper training of the personnel, and through full co-operation by all concerned in creating safety-mindedness.

The granting of bonuses in enterprises where the personnel have conducted themselves in a manner calculated to prevent accidents can also be an extremely effective means of improving the standard of safety."

- The responsible Mines Inspectorate has rejected implementation of this Recommendation, holding the view that this is a matter for the two contracting parties.

b) Federal Republic of Germany (Saar)

A total of 5 Recommendations have not yet been implemented, two of which are being examined with a view to deciding what measures to take (E) and three having been rejected (A).

- The following Recommendations are still being examined:

1) A - 3, page 92, Conference Report

Refresher courses for inspectors' assistants and workers' delegates

"The Conference considers that the Mines Inspectorate should organize regular refresher courses for inspectors' assistants and workers' delegates, in order to ensure that their technical training is always adequate to what is required of them."

2) C, page 95, Conference Report

Participation by workers in safety inspection

"It is considered that foreign workers should be allowed to participate in safety inspection on the same terms as nationals of the country concerned."

- The following Recommendations will not be applied in the regulations:

3 - 4) I - 1st and 2nd paras., safety departments in enterprises - exchanges of information

(For text see above under II a) 1)

The responsible Inspectorate considers that these two Recommendations cannot be laid down by the Inspectorate.

5) A - 2 - 2nd para., pages 91/2

Revision of the status of the entire Mines Inspectorate staff

(For text see above under II a) 2)

As in the previous case, this applies only to the 2nd paragraph of this Recommendation.

c) Belgium

In a total of 15 cases the Recommendations have not yet been implemented. 7 Recommendations are still being checked (E), 7 Recommendations will not be embodied in the Regulations (A) and no decision has yet been reached with respect to one further Recommendation (?).

- The following Recommendations are still being examined with a view to preparing regulations:

1 - 2) D - 1 and 2, page 83

Safety Departments and Enterprises

"1. There should be an adequate number of safety personnel, and they should work full time on safety and health, to the exclusion of all other duties. In cases where this is not practicable, exceptions should be made only with the approval of the Mines Inspectorate.

2. Safety personnel, of whatever grade, should be given rank and pay equivalent to those of operational personnel with the same qualifications."

3) A - 2, pages 86 & 87, Conference Report

Organization of the supervision of safety arrangements within the enterprises

"The Conference considers that:

1. The coal-owner must place every underground workplace or working and all work carried out below ground under the management, direction, supervision or responsibility of persons whose functions and obligations must be clearly defined and communicated to the competent authority.

2. Every member of the managerial or supervisory staff to whom such duties are assigned must possess the appropriate qualifications as recognized by the competent authority."

In the above passage it is the Recommendation contained in the second paragraph which is still being examined with a view to implementation.

4 - 5) B - 3rd and 4th paras., page 89, Conference Report

Framing of regulations and inspection for compliance with them - exemptions

"It is desirable that there should be consultation between the employers and the workers regarding any exemption.

The Conference considers it essential that in any event the bodies representing the workers' interests within the enterprise should be notified of all exemptions granted during the period concerned."

6) A - 1, page 91, Conference Report

Number of inspection appointments

"The Conference recommends .... that strong representations should be made to the various Governments to raise, if necessary, the number of inspection appointments (Inspectors, Assistants, and Workers' delegates), which will make it possible to increase the number of inspections."

7) A - 3, page 92, Conference Report

Refresher courses for inspectors' assistants and workers' delegates

(For text see above under II b) 1)

- The responsible authority will not embody the following Recommendations in new regulations:

8) G, page 84, Conference Report

Safety Departments in Enterprises

"The Conference considers that "besides the safety department, specialist staff on the operational side may be made responsible for certain matters of particular importance in connection with safety. Like the operational staff generally, these men should be administratively independent of the safety department, but they should work in intimate co-operation with it.

The management must make all appropriate arrangements to avoid any conflict of authority between the safety and operational departments."

9) I - 2nd para., page 85, Conference Report

Safety Departments in enterprises, exchanges of information

(For text and remarks see above under II a) 1)

10 - 11) A - 1 - 2nd and 3rd paras., page 88, Conference Report

Organization of inspection departments

"Since in the pits and their surface buildings and installations safety is a single integrated element, yet presents two separate aspects, the technical and the social, it is considered that the work of the Mines Inspectorate should be so organized as to take this fact into account.

It is, therefore, felt to be essential that safety, health and technical inspection in the mines should be carried out by one and the same inspection service, the inspectors to have all the qualifications required for this purpose.

The departments and organizations which have to study the inspection reports and to take action accordingly must be answerable only to the Minister responsible for the mines. The Minister will, where appropriate, inform the colleagues of observations made on matters concerning them and either arrange with them, or leave it to them to decide, what action, if any, is to be taken."

The responsible authority has rejected any implementation of the Recommendations in the foregoing paragraphs 2 and 3.

12) A - 2, page 89, Conference Report

Delegation of authority

"The Conference is of the unanimous opinion that where authority or partial authority concerning safety in mines is delegated by the Minister, it should be delegated only to the Mines Inspectorate.

The Mines Inspectorate should, however, inform the national, regional or local authorities, to such extent as may be deemed necessary, of the action taken in virtue of this delegation of authority."

13) A - 2, 1st para., pages 91 and 92, Conference Report

Revision of the status of the entire Mines Inspectorate staff

"The Conference is of the unanimous opinion that a revision of the status of the entire Mines Inspectorate staff is imperative. It is desirable that the Governments concerned should see to it that the standing of the personnel of the Mines Inspectorate is such as to ensure satisfactory recruitment and retention of staff.

14) A - 1, page 97, Conference Report

Prosecution of offences against safety regulations

"The Conference therefore desires that the prosecutions requested by the Mines Inspectorate following particularly flagrant and clearly proven offences, which greatly affect general safety, should lead to appropriate penalties."

- There is still uncertainty with regard to the steps to be taken in respect of the following Recommendation.

15) A - 2, 2nd para.

Following the text quoted above under 13, there is for the second paragraph, quoted below, still uncertainty as to how to implement the following Recommendation:

"In return, it is felt that the Government may reasonably require them to work in the Inspectorate for a stated minimum period, and to engage full-time in their inspection duties."

d) France

Implementation has not yet been completed for a total of 10 Recommendations, of which 8 are being examined with respect to the decisions to be taken and two of which will not be implemented.

- The following Recommendations are being examined:

1 - 2) B - 1 and 2, page 82, Conference Report

Safety Departments in enterprises

"1. There should be in each country an Act or Regulation making it compulsory for every enterprise to set up at least a safety department.

2. Furthermore, minimum requirements should be laid down concerning
   - the duties and functions of such a department;
   - the qualifications and abilities needed by its staff;
   - the general principles on which it is to be organized (to be implemented in accordance with practical experience, in co-operation with the Mines Inspectorate)."

3) C - 3rd para., page 83, Conference Report

Appointment of leaders and staff of safety departments

"It would be advisable for the colliery manager to make sure, particularly from the men's representatives, that the safety personnel appointed would be acceptable to the men."

4) D - 1, page 83, Conference Report

(For text see above under II c) 1)

5) A - 2, page 86, Conference Report

Organization of the supervision of safety arrangements within the enterprises

(For text see above under II c) 3), para 2)

6) Para.3, page 90, Conference Report

Framing instructions

"The Conference recommends that when such instructions are drawn up by the employer, the latter shall consult the Safety Committee on which the workers are represented."

7) D - 1, page 90, Conference Report

Composition of the Consultative Councils and Committees for Safety Problems assisting the Minister responsible for the mines

"The Conference regards it as desirable that all Councils and Committees assisting the Minister responsible for the mines dealing with safety matters should include representatives of the employers and of the workers."

8) C, page 95, Conference Report

Participation by workers in safety inspection

(For text see above under II b) 2)

- In the following two cases, the regulations will not embody the Recommendations:

9) C - para. 2, page 83, Conference Report

Appointment of the leaders and the staff of the Safety Department

"The colliery management should consult the bodies representing the workers' interests in the enterprise before taking any decision with regard to the appointment of leaders and staff of the safety department."

10) F - 2nd para., page 84, Conference Report

Tasks of the safety department

"The safety department must, however, have the right to decide itself on the action to be taken in the event of imminent danger, provided it notifies the management later."

e) Italy

Fourteen Recommendations have still not yet been implemented, 1 Recommendation still being examined (E), while in nine cases the Recommendations will not be accepted (A) and with regard to another four Recommendations there is uncertainty as to what decisions will be taken (?).

- The following Recommendation is still being studied with a view to the preparation of new regulations:

1) B - 2, pages 94/95, Conference Report

Participation by workers in safety inspection

"In view of the differences which exist between the systems in force in the countries of the Community as regards the position of the workers' delegates in relation to the Mines Inspectorate (method of appointment, powers, subordination), the Conference considered that any attempt to alter the system would be a somewhat complicated matter, which is better left to the discretion of the various countries themselves. It is, however, essential that due account be taken of the following recommendations, which have been approved unanimously by the Conference.

Workers' delegates engaged on safety inspection under the Mines Inspectorate must

- work solely and wholly on safety inspection, to the exclusion of all other duties and appointments (e.g. personnel representatives);
- be independent of the enterprises they are called upon to inspect;
- possess the essential knowledge and capability before taking up their duties;
- be given thorough training and regular refresher courses;
- be paid at the same rate as operational underground workers with the same qualifications.

The Mines Inspectorate must see to it that these conditions are fulfilled."

- The responsible authority has rejected implementation of the following Recommendations:

2 - 3) C - 2nd and 3rd paras., page 83, Conference Report

Safety departments in enterprises

"The colliery manager should consult the bodies representing the workers' interests in the enterprise before taking any decision with respect to the appointment of the leaders and staff of the safety department.

It would be advisable for the colliery manager to make sure, particularly from the men's representatives, that the safety personnel appointed will be acceptable to the men."

4) F - 2nd para., page 84, Conference Report

(For text see above under II d) 10)

5) G, page 84, Conference Report

Responsibility of the officials for certain safety problems

"The Conference considers that, besides the safety department, specialist staff on the operational side may be made responsible for certain matters of particular importance in connection with safety. Like the operational staff generally, these men would be administratively independent of the safety department, but they should work in intimate co-operation with it.

The management must make all appropriate arrangements to avoid any conflict of authority between the safety and operational departments."

6) I - 1st para., page 85, Conference Report

Safety departments in enterprises - exchanges of information

The Conference recommends that exchanges of information be organized among officers of the safety departments of the different collieries. It is further considered that the Mines Inspectorate should take part in such exchanges from time to time."

7) B - para. 4, page 89, Conference Report

Framing of regulations and inspection for compliance with them - exemption

"The Conference considers it essential that in any event the bodies representing the workers' interest within the enterprise should be notified of all exemptions granted during the period concerned."

8) C - para. 3, page 90, Conference Report

Framing of instructions - consultation with the workers

(For text see above under II d) 6)

9) C, page 95, Conference Report

Participation by workers in safety inspection

(For text see above under II b) 2)

10) B, page 97, Conference Report

Disciplinary action in the event of breaches of safety regulations

(For text see above under II a) 3)

- There is still uncertainty about the implementation of the following Recommendations:

11) D - para. 2, page 83, Conference Report

Safety departments and enterprises

(For text see above under II c) 2)

12) I - para. 2, page 85, Conference Report

Safety departments in enterprises - exchanges of information

"It is recommended .... that such exchanges should be arranged not only at pit, coal-field or national level, but also at Community level."

(Also see the first para. in this connection: For text see above under II e) 6)

13) A - 2 - para. 2, pages 91/2, Conference Report

Revision of the status of the Mines Inspectorate staff

(For text see above under II c) 15)

14) A - 3, page 92, Conference Report

Refresher courses for inspectors' assistants and workers' delegates

(For text see above under II b) 1)

f) Netherlands

The Netherlands have implemented all 55 Recommendations in the fields of safety regulations, safety supervision and participation by workers in safety inspection.

C. RECOMMENDATIONS REGARDING HUMAN FACTORS

a) Federal Republic of Germany (North Rhine/Westphalia)

Of the total of 74 Recommendations of the Conference in this field, one part of a Recommendation is still being studied (CE); in 5 cases the Recommendations will not be applied (A) and in 3 cases they will be only partly applied (CA).

- The text which is still being studied is as follows:

1) Para. 4, page 107, Conference Report

Entrants undergoing medical and psychological examination

"In view of the ever-present and widely-varying hazards in coal-mines, medical and psychological examination should not be confined, as is frequently the case in other industries, men assigned to strenuous or dangerous occupations; it should be extended to the entirė personnel, carried out with due thoroughness and attention to detail, and based on special, carefully-defined criteria."

- No application will be made of the 5 Recommendations listed below:

2) Para. 9, page 103, Conference Report

Practical reception methods: organization

"In the country of recruitment, especially in the case of collective recruitment, it is necessary to organize "assembly centres" responsible for seeing that, in areas where workers are recruited on a considerable scale, they are given material and moral assistance (lodging, administrative formalities, etc.), medical examination to ensure that they are physically fit for work in the pits, adequate and unbiased information concerning their future life as miners, including its hazards, and if possible a certain amount of guidance. The Committee concerned recommends in particular that in the case of collective recruitment in a country of emigration, the country concerned should see that its assembly centres receive migrant workers under the most favourable material and moral conditions and provide such workers with appropriate information on the life awaiting them."

3) Para. 2, page 110, Conference Report

Methods of observing and assessing individual miners at work

"Inasmuch as various specialists have to observe the men at work and/or make assessments concerning them, more particularly in connection with time and motion studies, job analysis, job evaluation, etc., it has been found that, although essentially of a technical and economic nature, these special work-study methods offer excellent opportunities

- for detecting dangerous situations, practices and equipment,
- for checking whether the man is properly adjusted to his work, and consequently,
- for introducing certain preventive and remedial measures designed to improve safety.

All those concerned with safety (managerial and supervisory staff, medical practitioners, psychologists, safety engineers, etc.) should be associated with the employment of these work-study methods. They would thus be enabled, quite apart from the regular tours of inspection and leaving it to the specialists actually to implement the methods concerned, to extend their knowledge of the men's working conditions and behaviour, and to submit their views with the object of ensuring greater safety".

4) Para. 10 a, page 123, Conference Report

Psychological and sociological aspects of the environment - Problems in connection with foreign workers

"Foreign workers should be given instruction in the language of the country of reception for a suitable period, according to the prevailing circumstances, such instruction to include in particular technical mining terms and expressions, and the instruction period to count as paid working time." (1)

5 - 6) Paras. 10 c and 10 d, page 123, Conference Report

Problems in connection with foreign workers

"10 c - As far as possible, the instructors in charge of the training of foreign workers should have an adequate knowledge of the workers' language as well as that of the country of employment.

10 d - So far as possible, every team should include at least one worker with an adequate knowledge of both languages."

- In the case of the following Recommendations, only part will not be applied:

7 - 8) Paras. 7 and 8, pages 102 and 103, Conference Report

Reception of new workers - Responsibility for reception

"7 - Outside the enterprise, where men have been recruited some distance away (either in the same country or abroad), and more particularly in the case of collective recruitment, responsibility for the reception organizations set up in the country of recruitment and/or employment should be shared as may be deemed most suitable between the local or national authorities and the employers. It is recommended that the workers should also be associated with these activities. Under no circumstances should responsibility for reception arrangements be delegated to outside commercial bodies.

8 - Within the enterprise, the reception services are the responsibility of the employers. It is recommended that they should be organized in co-operation with the trade unions.

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(1) The responsible authority here states that it cannot embody this Recommendation in regulations, and that it is much more a matter for the two contracting parties.

Every enterprise or group of enterprises should have a special reception department on a permanent basis, working in co-operation with the other social services and with the vocational-training department, which have themselves a contribution to make as regards reception. Reception cannot, however, be carried out satisfactorily by one single specialized department:
it requires an atmosphere of mutual understanding and co-operation all round, particularly from the supervisory staff, who need to be specially trained for this purpose."

9) Para. 10 f, page 123, Conference Report

Problems in connection with foreign workers

In addition to translations of the safety and operational rules and regulations, it is further recommended that the enterprise should provide foreign workers with translations of all other technical documents of value in connection with their further training.

b) Federal Republic of Germany (Saar)

Implementation has not yet been achieved in a total of 20 cases in this field. In detail the situation is:

4 Recommendations are still being studied (E), in 12 cases the examination has only been partially completed (CE), 4 Recommendations will not be applied in part (CA) and 1 Recommendation has been referred back to the Mines Safety Commission (EOP).

- Examination of the following Recommendations is not yet completed:

1) Para. 1 - 1st sentence, page 106, Conference Report

Medical and psychological examination - Medical and psychological supervision

"As the psychological and pathological condition and the intelligence and character rating of the personnel can affect safety,measures concerning the medical and psychological examination and supervision of the workers should be introduced generally."

2) 1 - para. 5, 1st sentence, page 106, Conference Report

Medical and psychological examination - Medical and psychological supervision

"Suitable medical, and if necessary psychotechnical, supervision should be carried out regularly and systematically, to ensure that each worker is always in a fit state to perform his duties in a normal manner."

3) Para. 8, page 108, Conference Report

Aims and objects of medical and psychological supervision

"Medical and psychological supervision should be carried out periodically throughout the worker's career, with the object of making sure that he is at all times fit for his job from the safety point of view, of helping to get him employed on the right type of work at different stages in his career, and of protecting his health generally. Supervision should cover both the medical and the psychological aspects."

- In the case of the following Recommendations examination is still proceeding in part, especially in connection with psychological problems:

4) 1 - para. 5, 2nd sentence, page 106, Conference Report

Medical and psychological examination

"Where a worker is found unfit to perform his duties in a normal manner, such worker should be assigned to more suitable duties, as far as possible in the same colliery."

5) Para. 3, page 107, Conference Report

Aims and objects of medical and psychological examination

"The pre-entry examination should not be confined solely to the physical and pathological side on the basis of a medical examination, but should if necessary include the use of applied psychology with the object of ascertaining the character and mental abilities of the subject."

6 - 7) Paras. 5 and 6, pages 107 and 108, Conference Report

Medical and psychological services

"5 - Every enterprise or group of enterprises should have a medical service and an applied-psychology service, each with proper facilities and equipment at its disposal. These services should work in close co-operation as regards pre-entry examinations(and subsequent supervision); it would also be of value to institute or extend co-ordination among the various medical services and among the various applied-psychology services."

"6 - Medical examinations must be carried out by qualified medical practitioners experienced in industrial medicine in collieries and working in consultation with specialists in the various branches of the profession whenever necessary. Psychological examinations must be carried out by competent psychologists with adequate knowledge of the structure of the enterprise, the environment and the working conditions."

8) Para. 10, page 114, Conference Report

Shortened training for juvenile workers

"Wherever it is not possible to send boys to an apprenticeship centre, they should be given systematic training including theoretical instruction at the surface and practical instruction in a surface training gallery and at reserved training faces. Upon completion of such courses, they should receive a certificate of proficiency, and should subsequently be specially supervised for some months."

9 - 12) Paras. 13 to 16, pages 115 to 116, Conference Report

Intensified training of adults

"13 - Every adult entrant must be given systematic training according to a detailed programme drawn up in advance and falling into the following three stages:

- systematic intensified preliminary training, to be given by qualified instructors at special centres above and below ground, and lasting not less than two to three weeks when the teaching methods employed are those suited to intensified training;

- follow-up training supplementary to the intensified preliminary training, provided at training faces, and lasting not less than six weeks when the teaching methods employed are those suited to intensified training; during this period, the trainee to work under an instructor responsible at a single face for three to six trainees (but not more), the instructor in no circumstances to have any connection with the production side;

- a period during which the trainee is employed in easy workings under suitable supervision.

Promotion from one stage to another should be made on the advice of a responsible instructor, and promotion from stage 3 to regular production work on the advice of the supervisors or inspectors."

"14 - On completion of stage 2 of this intensified training for adult workers, the trainee should receive a certificate of proficiency stating the type of training received."

"15 - Where no system of training by qualified instructors in accordance with the principles referred to in subsection 13 above has yet been introduced, the "worker-and-mate" system (with a senior worker initiating newcomers) may be used only as a temporary arrangement pending the introduction of the methodical training outlined above. Where this situation obtains, training should fall into two stages:

- systematic intensified preliminary training to be provided by qualified instructors and lasting not less than two to four weeks when the teaching methods employed are those suited to intensified training;

- follow-up training of the "worker-and-mate" system, designed to supplement the intensified preliminary training, and lasting not less than three months to one year; so far as possible the ratio of trainee to skilled miner under this system should be one-to-one."

"16 - The skilled worker instructing newcomers must be primarily concerned with teaching his "mate", not (so far as his wages are concerned) with production. Wherever this type of training is still practised, the work the new entrants are set to do (especially those with non-mining backgrounds) should be carefully graded to enable them to adapt themselves to the job as time goes on, so as to prevent any over-taxing of their capacity or psychological reaction detrimental to safety."

13) Para. 21, page 132, Conference Report

Training of managerial and supervisory staff

"Promotion to the higher grades of the supervisory staff must be preceded by special advanced training, taking the form of either intensive training periods, or of periodic instruction, or both. To this end, each country should have one or more training-centres for the higher supervisory appointments (second-stage training)."

14) 4, page 119, Conference Report

Physical aspects of the environment

"Complaints attributable to the effects of physical factors inherent in the environment should rank as occupational diseases."

15) 8, page 130, Conference Report

Difficult and unhealthy working conditions

"Endeavours should be made to frame appropriate regulations in respect of the special conditions associated with difficult or unhealthy work. In the arrangement of working hours allowance should be made for extra fatigue due to the difficult or unhealthy character of certain workings, particularly those where the temperature is unusually high."

- No application will be made of parts of the following Recommendations:

16) 8, page 116, Conference Report

Responsibility for reception

(For text see above under III a) 8)

17) 11, page 104, Conference Report

Practical reception methods: organization

"Finally, the enterprise must have a reception department for both native and foreign workers, in order to establish a welcoming atmosphere, and to facilitate the adaptation of the newcomers to their new living and working conditions.

This department must help the men with the necessary engagement formalities, see that they become properly familiar with the colliery, and continue to look after them during the period of adaptation."

18 - 19) 12 and 13, pages 104 and 105, Conference Report

Practical reception methods: facilities

"12 - The process of acquainting the newcomers with the set-up and working of the enterprise, carried out by the methodical employment of appropriate measures, is more effective if it is arranged with the assistance of senior workers. In the case of foreign workers, all necessary action should be taken to dispose of language difficulties and to facilitate the psychological and social adjustment of the men concerned to their new living and working conditions and surroundings.

To this end the reception department should provide the newcomers with information, in a language they understand, on the collieries, the workers' organizations and the conditions regarding work and particularly, safety, and should establish contact with the services dealing with the workers, especially the social services. Workers speaking a language other than that of their future environment should be received by representatives able to understand them and make themselves understood by them."

"13 - Adaptation to work at the colliery is a process extending over a certain period of time, lasting anything from a few weeks to several months, during which the reception department should maintain contact with the newcomers in order to give them all necessary assistance, for instance by visiting them and arranging meetings for them. During the same period, the departments with which the newcomers are in contact, and particularly the social services, should take up and extend the work of the reception department. Finally, in the department to which he is ultimately appointed, the newcomer's superiors and fellow-workers should give him whatever help he needs and a welcome which will make it easier for him to settle down well to his job."

- The following Recommendation has been referred back to the Safety Commission for check and amplification:

20) 25, page 118, Conference Report

Training

"The Trade Unions should be associated with the organization of vocational training."

c) Belgium

In 14 cases the Recommendations have not yet been implemented: this applies in detail to 8 Recommendations which are still being checked (E), 5 Recommendations which are still partly being checked (CE) and 1 Recommendation in respect of which there is still uncertainty (?).

- The following Recommendations are still being examined:

1) 3, page 107, Conference Report

Aims and objects of medical and psychological examination

(For text see above under III b) 5)

2) 6, pages 107/108, Conference Report

Medical and psychological services

(For text see above under III b) 7)

3) 7, page 108, Conference Report

Medical and psychological services

"The medical practitioners and psychologists concerned must have full professional independence and full responsibility in conducting their examinations and making diagnoses. They must be given every facility for calling in specialists in doubtful cases, while the employer must retain full responsibility as to whether or not he engages an applicant on the basis of the fitness grading certified by the medical practitioner and psychologist."

4 - 6) 9 and 10, sentences 1 and 2, and 3 and 4, pages 108/109, Conference Report

Practical methods of medical and psychological supervision

"In the case of juvenile workers, special attention must be given to their regular supervision, with the object of watching their physical development and assessing their adaptability to conditions in the pit. They should be re-examined at least once a year.

In the case of adult workers, all personnel should be re-examined at regular intervals, with particularly frequent and systematic checks on those employed on strenuous, dangerous or unhealthy work, and on any men of weakly constitution, in bad health or showing predisposition to illness. All transfers or promotions involving an appreciable change in working habits must be preceded by re-examination to detect any contra-indications and help to ensure that the subject will be put on to work suited to him. If any contra-indication as regards underground work is found, the worker must be given more suitable work, so far as possible at the same colliery. In carrying out this medical supervision, the doctor should take into account the conditions under which the man has to work."

7 - 8) 2 and 3, pages 110/111, Conference Report

Methods of observing and assessing individual miners at work

(For text of para. 2, see above under III a) 3)

"3 - In the course of their regular duties, the managerial and supervisory staff have the opportunity of keeping a constant check on whether the men are properly placed in, and adapted to, their jobs. Their attention should, therefore, be drawn to this aspect of their responsibilities, in order that they may make any suggestions they consider necessary as to the transfer of men to more suitable work or further vocational training."

- The following Recommendations are still partly being examined:

9) 1 - Paras. 2, 3 and 4, page 106, Conference Report

Medical and psychological examination - Medical and psychological supervision

"Medical examination of mine-workers prior to their engagement and to any important change of job should be made compulsory, such examination to be supplemented if necessary by a psychotechnical or equivalent examination in respect of jobs calling for special physical and/or psychical qualities.

The examination should be carried out by a specially-appointed medical practitioner possessing the requisite qualifications and working in conditions which make it possible for him to perform his duties entirely on his own responsibility and in complete independence. In the case of mass recruitment of foreign workers, a thorough medical examination should be carried out prior to departure from the country of origin.

In addition, the Governments should encourage the establishment and extension of colliery medical services, and more particularly of arrangements adapted to the working conditions in mines for giving first aid quickly to workers injured in the course of their work."

10) 1 - Para. 5, 1st sentence, page 106, Conference Report

(For text see above under III b) 2)

11) 4, page 107, Conference Report

Entrants undergoing medical and psychological examination

(For text see above under III a) 1)

12) 5, page 107, Conference Report

Medical and psychological services

(For text see above under III b) 6)

13) 8, page 108, Conference Report

Aims and objects of medical and psychological supervision

(For text see above under III b) 3)

- There is still uncertainty with regard to the implementation of the following Recommendation:

14) 1 - Para. 1, page 106, Conference Report

Medical and psychological examination

(For text see above under III b) 1)

d) France

All 74 Recommendations have been implemented, either by means of regulations or laws, or de facto. Under the heading "Medical and psychological examination - Medical and psychological supervision" which covers a total of 14 Recommendations, it is additionally pointed out that these regulations are very largely carried out in practice in France in medical examination and supervision, but that the psychological examination and supervision is applied only to clearly-defined categories of staff whose activities are of considerable importance in connection with safety.

e) Italy

Of the 74 Recommendations, 18 have been implemented hitherto; of the 56 Recommendations not yet implemented, 47 are still being examined (E), 8 will not be applied (A) and there is still uncertainty about 1 Recommendation (?). In the introduction it is stated that in the 8 cases where Recommendations will not be applied, this covers texts dealing with the problems of foreign workers, a question which does not arise in the Italian mining industry.

- The following Recommendations are still being examined:

1 - 2) Pages 103/104, Conference Report

Practical reception methods: organization

"10 - In the country of employment, it is necessary to organize "reception centres", with responsibility mainly for helping the migrant workers over the initial stages and channelling them forthwith to the reception departments of the collieries. Where no such reception centres exist, the enterprises concerned must start their reception work from the moment entrants coming from a distance first arrive at the station, to ensure that they and their families are given all the assistance they may need to enable them to settle in."

11 - (For text see above under III b) 17)

3 - 6) 1 - Para. 1, page 106; Paras. 2, 3 and 4, page 106; Para. 5, 1st sentence, page 106; Para. 5, 2nd sentence, page 106, Conference Report

Medical and psychological examination and supervision

(For text see above under III b) 1); III c) 9); III b) 2) and III b) 4)

7) 3, page 107, Conference Report

Aims and objects of medical and psychological examination

(For text see above under III b) 5)

8) 4, page 107, Conference Report

Entrants undergoing medical and psychological examination

(For text see above under III a) 1)

9 - 11) 5 to 7, pages 107/108, Conference Report

Medical and psychological supervision

(For text see above under III b) 6); III b) 7) and III c) 3)

12 - 13) 2 and 3, pages 110/111, Conference Report

Methods of observing and assessing individual miners at work

(For text see above under III a) 3) and III c) 8)

14 - 15) 1 and 2, 2nd paragraph, page 112, Conference Report

Vocational training - Aims and objects of general recommendation

Each individual must be given training appropriate to the job assigned to him.

All vocational-training schemes must take due account of safety requirements.

16 - 19) 4 - Para. 2; Para. 3; Para. 4 and Para. 5, pages 112/113, Conference Report

Training requirements

The training must be based on systematic, carefully-adapted training scheme.

The instructors must be specially trained, employed full time on teaching and not connected with the production side.

The instructional facilities and equipment must make it possible to provide instruction in progressive stages.

The systems and methods of vocational training should be based on the general principles set forth in Resolutions Nos. 13 and 46 adopted by the Coal Mines Committee of the International Labour Organization at it's Second and Sixth Sessions.

20 - 21) <u>8 and 9, page 114, Conference Report</u>

<u>Full systematic training of juveniles</u>

The systematic training must be provided for a minimum period in specialized apprenticeship centres.

Every colliery should have facilities for apprentice training providing three years' training for the boys. On the completion of the apprenticeship a trainee should be given a proficiency certificate; the boys should be formed into groups from time to time to undergo further training.

22) <u>10, page 114, Conference Report</u>

<u>Shortened training for juvenile workers</u>

(For text see above under III b) 8)

23 - 27) <u>12, 2nd sentence, page 115; 13, page 115; 14, page 115; 15 and 16, page 116, Conference Report</u>

<u>Intensified training of adults</u>

"The instructors must be full-time specialists and must not have anything to do with the production side."

(For text of 13 to 16 see above under III b) 9) to 12)

28 - 29) <u>17 - Paras. 1 and 17 - Paras. 2 and 3, page 116, Conference Report</u>

<u>Training of specialists</u>

"As regards electricians, locomotive-drivers and all other personnel with collective responsibilities, or engaged on especially responsible work, the "worker-and-mate" training system should be forbidden, and appointment to such jobs should be subject to selection for ability.

Shotfirers must be given adequate and systematic vocational training. Such training should carry a certificate valid for a specified period only, and should be repeated at regular intervals.

Training and retraining in shotfiring should also be provided for the supervisory staff immediately concerned."

30 - 33) <u>18, 19, 20 and 21, page 117, Conference Report</u>

<u>Training of managerial staff, with special reference to supervisory personnel</u>

A considerable proportion of their training should be aimed at ensuring that they are thoroughly familiar with the safety regulations and accident-prevention measures.

The training and further training of the supervisory personnel should therefore give special attention to preparing the supervising staff to take their full share of responsibility in the leadership and safety.

Appointments to the supervisory staff should be possible only upon completion of a course of special training. A certificate of proficiency should be conferred upon completion of the supervisor's training.

Promotion to the higher grades of the supervisory staff must be preceded by special advanced training; training-centres must be set up for the higher supervisory appointments.

34 - 36) <u>22, 23 and 24, last sentence, page 118, Conference Report</u>

<u>Training of instructors</u>

Training of instructors can only be provided effectively by specially-selected staff trained in the use of instructional methods suitable for teaching coal-mining subjects.

The instructors must be given special training for their duties by highly-qualified teachers.

Establishment of an instructors' training centre.

37) <u>25, page 118, Conference Report</u>

(For text see above under III b) 20)

38) <u>4, page 119, Conference Report</u>

<u>Physical aspects of the environment</u>

(For text see above under III b) 14)

39) <u>5, page 125, Conference Report</u>

<u>Method of payment of supervisory staff</u>

"The pay of the supervisory staff should be fixed in such a manner as to enable them to bear their full share of responsibility regarding safety without suffering any disadvantage in regard to their wages."

40) <u>7, page 125, Conference Report</u>

<u>Method of payment of shotfirers</u>

"In a number of countries shotfirers are not paid at piece rates. Shotfirers should have a financial interest in seeing that shotfiring is carried out in accordance with safety regulations, and their position of responsibility in regard to safety should be duly remunerated".

41) <u>9 a, sentences 1 and 2, page 126, Conference Report</u>

<u>Piece work</u>

"When he is paid at piece rates, the worker must be able to take all necessary safety precautions without thereby incurring any loss in wages. The piece rate paid must therefore allow for the time taken up by safety duties carried out in accordance with regulations; In order to facilitate this for all concerned, the Conference recommends the High Authority to prepare a comparative survey of methods now used in the various member countries to make allowance for safety duties in the calculation of piece rates."

42 - 44) <u>9 d, para. 2; 10 and 11, pages 126/127, Conference Report</u>

<u>Piece work rates</u>

"In all cases where those employed on piece work include a considerable proportion of foreign workers, special care should be taken to ensure that the latter are suitably represented at such discussions.

It is recognized that piece work necessitates particular alertness to safety on the part of the supervisory staff. The training and rates of pay of the supervisory staff should be specially fixed to allow for this.

Where one of the men is given special responsibilities for a team in regard to safety, the piece rates paid him must make allowance for the time he has to spend on safety duties.

It is, in particular, essential that only men who have undergone adequate vocational training should be put on piece work."

45) 8, page 130, Conference Report

Difficult and unhealthy working conditions

(For text see above under III b) 15)

46 - 47) 5 and 6, pages 131/132, Conference Report

Measures against alcoholism

"The measures already adopted to combat alcoholism should be kept up. Enterprises are recommended to provide their personnel with healthy drinks."

Housing

"All miners should be housed within a reasonable distance from their work, in accommodation adequate to their requirements and those of their families. Social amenities (shopping, educational, cultural and religious facilities) should be provided in proportion to the size of the population. Housing should be allocated on as practical a basis as possible, with the object of integrating miners' families into the population of the area as a whole.

For unmarried workers specially-adapted hostels should be provided, equipped with suitable educational and cultural facilities.

Migrant workers should be enabled to find suitable accomodation fairly quickly."

48) 12, page 104, Conference Report

Practical reception methods: facilities

(For text see above under III b) 18)

49 - 55) 9, 10 a, b, c, d, e and f, page 123, Conference Report

Problems in connection with foreign workers

"9 - Wherever foreign workers are employed in coal-mining they should be given the opportunity to acquire an adequate knowledge of the language of the country in which they are working. Such knowledge affects safety, inasmuch as it helps to prevent misunderstandings between one miner and another and between miners and supervisory staff."

"10 a - (For text see above under III a) 4)"

"10 b - On every shift on which foreign workers are employed there should be at least one interpreter available, for so long as they are not able to make themselves properly understood in the language of the country."

"10 c and d - (For text see above under III a) 5 and 6)"

"10 e - The enterprises must provide foreign workers with translations of the safety and operational rules and regulations free of charge."

"10 f - It is further recommended that the enterprises should provide foreign workers with translations of all other technical documents of value in connection with their further training."

56) 7, page 102, Conference Report

Reception of new workers - Responsibility for reception

(For text see above under III a) 7)

f) Netherlands

The Netherlands Mines Inspectorate have implemented all Recommendations regarding human factors.

C H A P T E R T H R E E

IMPLEMENTATIONS OF RECOMMENDATIONS OF THE MINES SAFETY COMMISSION

The Recommendations, assessments, principles and reports prepared by the Mines Safety Commission since the beginning of its activities and distributed to the Governments and other interested bodies in accordance with its terms of reference, for further action or for information, can usefully be classified in two groups according to their implementation in time:

- Recommendations published in the First and Second Reports of the Mines Safety Commission, and
- Recommendations discussed in the present Third Report, the full text being given in appendices to this Report.

A.- SURVEY ON MEASURES BASED ON RECOMMENDATIONS OF THE FIRST AND SECOND REPORTS

The survey which follows shows the position on 1st January 1966, based on reports by Governments to the Safety Commission. From this tabulation it is possible to read off easily, without reference to any other documents, what action has been taken on the Recommendations of the Conference embodied in the First and Second Reports of the Mines Safety Commission. In the present Report the tables contain the text of the Recommendations (virtually unabridged), and the present position can be read off by means of the key to the symbols, given in Section B below.

Since this survey (like that further below in Section C II) gives for the first time information as at 1st January 1966, it would be premature to make any comments in detail; such comments will be reserved for one of the future reports. This will allow for a certain preparatory period before implementation of the recommendations, especially those issued in recent years.

Nevertheless, the reader will be able to see that the Recommendations listed in the following survey have, for the most part, been implemented, while the studies with a view to formulating new regulations have been finished in almost every instance.

In the small number of cases where the authorities have abstained from applying the regulations, the reason is in each case given in a footnote.

The following symbols are used in the tables:

C : The national regulations are already in accordance with the Recommendations

C' : The Recommendations have not been embodied in regulations, but have been implemented de facto

NRC : New regulations in accordance with the Recommendations have been drawn up and issued

NRP : The preparation of new regulations in accordance with the Recommendations is in hand

EOP : The national authorities consider that the Recommendations require re-examination by the Commission

E : The preparation of new regulations is being studied

? : There is uncertainty regarding the steps to be taken

A : The national authorities have abstained from bringing their regulations into line with the Recommendations.

Regular report on the implementation of the Conference's Recommendations

I. TECHNICAL ASPECTS

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Netherlands	
	1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966	
A - ELECTRIFICATION												
I - Recommendations regarding elimination of oil from underground electrical equipment (1st Report of Safety Commission, p. 7 (German text)).												
2a - Resistances installed underground should not contain any combustible oil. (Exceptions are allowed for the starting-up resistances of large motors driving water pumps).	C		NRP		NRP		E		C'		C	
b - Condensers and transformers installed underground must not contain either combustible oil, or dielectric substances which can give off noxious gases.	C		NRP		NRP		E		C'		NRP	
Otherwise effective measures should be taken against the dangers to workers caused by the use of these devices.	C		C		NRP		C'		C'		NRP	
c - Switches and relays, used underground and operating on voltages below 1,100 V, must not contain any flammable oils.	C		NRP		NRP		C'+ NRP		C'		NRP	
d - Protection of workers against dangers involved in the use of switches and relays, which work on voltages above 1,100 V and contain flammable oil.	C		C		NRP		C'		-(1)		C	
3. - Recommendation to continue research into the manufacture of low-oil or oil-less HT Switchgear and protective relays which can give riskfree service in gassy pits.	A(1)		-(2)		C'(3)		C'+ NRP		-(2)		NRP	
- Recommendation to begin detailed investigation into the degree of increased safety which can be achieved, with the intention of prescribing an explosion-proof housing only for normally spark-producing components, and a design of the "increased safety" type for all other equipment.	A(1)		-(2)		C'(3)		E(4)		C'		NRP	

(1) = cannot be laid down in inspectorate regulations.

(2) = not applicable.

(3) = devices with satisfactory characteristics exist; the conditions of application must be specified.

(4) = approval regulations have been issued for equipment in the "increased safety" category. but the type of protection is left to the individual firms.

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Netherlands	
	1.1.1966		1.1.1966		1.1.1966		1.1.1966		1.1.1966		1.1.1966	
4. - Extending the use of low-oil or oil-less HT switchgear and oil-less HT protective relays at points where there is no gas risk.	A(1)		C		(2) NRP		C'+ NRP		C'		E	
II - <u>Recommendations for Shotfiring Leads</u> (Second Rept. of Safety Commission, p. 10).												
2. - <u>Recommendations for all Shotfiring Leads</u>												
- Every conductor must be provided with at least one good-quality insulation.	C		C		NRC		C		NRP		C	
- All connections must be properly insulated.	C		C		NRC		C		NRP		C	
- Every shotfiring lead must have the appropriate degree of flexibility.	C		C		NRC		C'		NRP		C	
- The conductors must be of such cross-sectional area that they do not occasion an excessive voltage drop.	C		C		NRC		C'		NRP		C'+ NRP	
- The shotfiring leads must be made up and laid so that the risk of any fault current - resulting from contact with metal objects - is reduced.	C		C		NRC		C		C		NRP + C	
- Before any shotfiring operation in particular workings and before the simultaneous firing of a fairly large number of shots, the ohmic resistance of the circuit must be measured.	C		C		NRC		C		C		C	
a - <u>Temporary shotfiring leads</u>												
- Careful inspection before each firing.	C		C		NRC		C		C'		C'	
- Regular and thorough testing by an expert either at the surface or in an underground workshop.	C		C		NRC		C		E		C'	
A thorough checking must consist of at least: - a careful inspection of the lead over its whole length;	C		C		NRC		C		E		C' + E	
- measurement of the insulation between the two conductors, if the lead consists of a cable or rubber-covered lead;	C		C		NRC		C		E		C'	
- measurement of the ohmic resistance of the lead.	C		C		NRC		C		E		C	

(1) = cannot be laid down in inspectorate regulations.
(2) = with regard to the approval of high-voltage switches.

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Netherlands	
	1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966	
b - Permanent shotfiring leads												
- Regular and thorough checks by an expert.	C		C		NRC		C		C'		-(2)	
- Written record of every thorough check, with the date.	A(1)		C		NRC		C'		E		-(2)	
3. - Further Recommendations for Permanent and Temporary Shotfiring Leads used in Gassy Mines.												
- The shotfiring leads must fulfil conditions which ensure sufficient safety, with regard to:												
a - mechanical strength and in particular tensile strength; bending and abrasion strength;	C		C		NRC		C'		NRP		C+C'	
b - electrical insulation;	C		C		NRC		C'		NRP		C+C'	
c - impermeability (to moisture) of the insulation and the sheathing.	C		C		NRC		C'		NRP		C'+ NRP	
- Recommendation that checking standards which correspond to the conditions be laid down.	C		C		NRC		-(2)		NRP		E	
4. - Supplementary Recommendations for Permanent Shotfiring Leads used in Gassy Pits.												
- Permanent leads should be so arranged that, as far as possible, damage during firing of the shots or from other causes is avoided.	C		C		NRC		C'		C'		-(2)	
- If the shotfiring lead consists of two separate conductors, these should be arranged sufficiently far apart and in such a way that inspection is possible.	C		CE		NRC		C'		C'		-(2)	
- In shafts and dipping roads, the leads must have an adequate mechanical strength.	C		C		NRC		C		C		C'	
III - Recommendations regarding the protection of underground distribution networks against the danger of causing electric shocks. (Second Report of the Safety Commission, p. 13)												
I - The following recommendations refer only to the MT networks defined below: Medium tension (MT): The normal voltage range for working equipment used underground with three-phase A.C. (between 380 and 1,100 V). These networks should fulfil all the recommendations set out below.												

(1) = seems unnecessary and would increase administrative work.
(2) = not applicable.

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Nether-lands	
	1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966	
These recommendations refer neither to the HT networks, nor to voltages which are lower than the medium-tension range and are used for particular purposes (lighting, drilling apparatus, telephone installations, etc.).												
II - Protection against the risk of electric shocks.												
A. First order precautions (Protection against direct contact with a live phase)												
1. Every chance contact with a live phase should be avoided as far as possible, by laying the conductor out of the workmen's reach, by interposing effective barriers or even by sheathing the phase or by insulating it.	C		C		C		C		C		C	
2. The cables and leads used in medium-tension underground networks should be protected either by means of a metal armouring connected to the pilot lead, or given mechanical protection by a flexible envelope of the best possible design.	C		C		C		C		C		C + NRP	
- Leads without metal armouring must be electrically protected by separate or common protective screens, which trip safety devices in the event of a fault.	C (1)		C		C		C		C		NRP	
3. Only trained men should be allowed to open the housings of accessible live parts (medium-tension voltage range) and this only under conditions which have been clearly laid down in advance.	C		C		C		C		C		C	
4. The repair and maintenance of the electrical equipment should be entrusted only to trained personnel.	C		C		C		C		C		C	
B. Second order precautions (Potential connection between conductive parts of the installation)												
1. All underground networks must be provided with an equipotential connection between the conductive (not live in normal operation)												

(1) = in the case of new cables.

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Netherlands	
	1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966	
components of the installation and the other metal elements connected thereto, such that its conductance is sufficient to prevent the occurrence, between any two points accessible to a workman simultaneously, of a voltage higher than the weak voltage.	C		C		C		C		C		NRP	
2. This equipotential connection (protective lead) must ensure electric connection between the conductive elements of the installation over the whole length of the network. It must be maintained in satisfactory condition and must be inspected as often as is necessary to ensure this.	C		C		C		C		C		NRP	
3. The above-mentioned equipotential connection (protective lead) must be earthed to at least one point of the network via an earth connection of the lowest possible resistance.	C		C		C		C		C		NRP	
4. This earth connection must be combined with the star-point earth connection, if a star-point is employed.	C		C		C		NRP		C'		NRP	
C. <u>Third order precautions</u> (Reduction of fault duration). 1. Any fault current must be considered dangerous in underground medium-tension networks if - when the fault current flows through the protective lead and connected conductive components of the installation or earth - there is produced between any two points accessible to a workman simultaneously a voltage exceeding the level of a weak voltage, regardless of whether it occurs only between parts of the installation or between such parts and earth.	C		C		C		NRP + C'		E		C	
2. <u>If the star-point of a network is earthed via a weak impedance or without any impedance, so that the presumed fault current is not restricted to a low value</u>, then the network must be provided with safety devices which can at any time automatically isolate the damaged section of the network from the current source (or render it completely dead), before the fault current flowing through the protective lead and connected conductive												

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Netherlands	
	1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966	
components of the installation or earth reach a dangerous value.	-(1)		-(1)		-(1)		NRP		E		NRP	
- Since the complete or partial cutting-off of a line voltage can have serious effects on the current supply to important equipment, suitable preventive measures should be taken. - Only when the line has been repaired or the fault eliminated, or at the direction of a specialist who has taken all necessary precautions, may that section of the network be brought under voltage again.	C		C		NRP		NRP		E		C	
3. <u>If the star-point of a network is insulated or earthed via some impedance, which restricts fault currents to a low value</u>, the network must be fitted with supervising devices which are always in a state of readiness and which are suitable: a - either to <u>check</u> the <u>insulation</u> of the various parts of the network and to <u>indicate any damage</u> they may have suffered or	C		C		NRP		NRP		E		NRP	
- automatically to cut off the <u>damaged section</u> of the network from its source of current (<u>or render the entire network dead</u>).	-(2)		C		NRP		NRP		E		NRP	
- If no automatic out-off device is installed, the responsibility for cutting-off should be entrusted to an expert man, who can intervene as soon as the warning signal of the supervisory system is tripped or the fault assumes major dimensions.	C		C		NRP		NRP		E		-(2)	
- If cutting-off has been necessitated by one of the two cases cited above, the <u>restoration of current may be accepted only after repair of the line or elimination of the fault only at the direction of an expert official</u>, who has taken all necessary precautions.	C		C		NRP		NRP		E		C	

(1) = not applicable, as only insulated circuits are used.
(2) = not applicable.

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Netherlands	
	1.1.1966		1.1.1966		1.1.1966		1.1.1966		1.1.1966		1.1.1966	
- If no automatic cut-off device is installed the rubber-covered leads of mobile machines must be fitted with an automatic device which renders them dead as soon as there occurs a fault current which is caused by damage to the external installation or by damage of the insulation to an individual phase;	C		C		NRP		C		E		NRP	
b - or automatically to cut off the damaged section of the network from its current source (or render the entire network dead), as soon as a double fault occurs leading to a dangerous fault current in the protective lead and connected parts of the installation. - In this instance the current may be switched on again only after the line has been prepared or the fault eliminated.	-(1)		-(1)		NRP		NRP		E		NRP	
N.B. The comments on this Recommendation are given in the Second Report of the Mines Safety Commission, pp. 16/23. B - MECHANIZATION AND LOCOMOTIVES I - Recommendations regarding locomotive equipment. (First report of the Safety Commission, p. 20 (German text)) 1. - New locomotives must be equipped with fixed, rigid cabins which at all times give the driver a clear view along the roadway, ahead and behind, without any need for him to put his head out of the cabin. (Fixed cabins are understood to cover those forming a part of the structure or which can be removed only laboriously with special tools).	(2)(3) C A		(2)(3) C A		NRP		(4)(5) C E		C		C	
2. - The locos in service must be modified to meet this requirement.	C		C		NRP		E		C		A	

(1) = not applicable.
(2) = in the case of main-road locos, with the exception of "a clear view behind", which is difficult technically.
(3) = no application made to gateroad locos because the risk of accident is increased.
(4) = for trolley locos.
(5) = for other than trolley locos.

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Nether-lands	
	1.1.1966		1.1.1966		1.1.1966		1.1.1966		1.1.1966		1.1.1966	
- locos which cannot be modified should gradually be withdrawn from service, within a period to be fixed by the responsible Inspectorate.	C		C		NRP		E		C		A	
- only to be used in roadways which are wide and high enough to eliminate accident risk.	C		C		NRP		E		A		E	
3. - For particular types of loco or in certain circumstances the responsible Inspectorate can grant exceptions from the above regulations in special cases of application, provided that safety regulations of equal stringency are laid down.	C		C		NRP		E		C(1)		E	
II - Recommendations regarding the neutralization of Diesel-engine exhaust fumes (First Report of the Safety Commission, p. 23 (German text)).												
- General use of better starters.	C		E		E		?		?		E	
- Intensified research into improving combustion by the use of catalysts.	A(2)		EOP		E		?		?		A(2)	
- Informing mining enterprises regarding the existence of this process.	-(3)		-(3)		-(3)		-(3)		-(3)		-(3)	
- Continuation of the research into an automatic transmission system, which would make it possible to give Diesel engines a constant rpm. Subsequent resumption of trials with the Houdry carbon monoxide purification process.	A(4)		EOP		E		?		?		A(4)	
C - FIRES AND UNDERGROUND COMBUSTION												
I - Recommendations regarding equipment for shafts in connection with the prevention of fires. (First Report of the Safety Commission, p. 11 (German text)).												
2. - Steps to prevent any accumulation of grease and coaldust (First Report of the S.C. p. 15 (German text) and Report of the Conference, p. 54, No. 2, para. C.)												
- Skip-winding installations should as far as possible be sited only in upcast shafts;	C'		A		E		A		C'		C	
- Equipment in new shafts should be of aerodynamic form.	C'		CE		E		E		E		C	

(1) = article 689 of Mining Regulations envisages a temporary exemption only.
(2) = not suitable for being laid down in inspectorate regulations.
(3) = not applicable.
(4) = not suitable for inclusion in inspectorate regulations.

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Nether-lands	
	1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966	
- all suitable steps should be taken to avoid in every case any accumulation of dust or to ensure that any such accumulation is removed.	C		C		NRC		C		C		C	
3. - <u>Preferred siting of methane-drainage lines in upcast shafts. (First Report of the Safety Commission, p. 16 (German text) and Report of the Conference, p. 54, No. 3, Para. (d))</u>. - This Recommendation of the Conference applies particularly to pressure lines.	C		C		NRC		E		A		C	
4. - <u>Siting electric cables, compressed-air mains and gas-drainage pipes</u>.(First report of the Safety Commission, p. 16 (German text) and Report of the Conference, p. 54, No. 3, Para e)). - Electric cables and leads, compressed-air drains and gas-drainage pipes should not be sited in the haulage compartment:	C		C		NRC		E		C'(1)		C	
- Electric cables should not all be sited in the same shaft.	C		C		NRC		E		C'		C	
II - <u>Guiding principles for fighting mine fires by sending down water. (Second Report of Safety Commission, p. 26)</u> 1. - <u>Installations</u> a - At the top of every shaft reaching to the surface there must be a device which can send down at least 50 litres of water per minute and per square metre of shaft cross-section.	C		C		NRC		E		E		C	
b - This device must be installed in such a way that the supply of water can at no time be seriously affected by drawing-off or flowing-away of water at other points.	C		C		NRC		E		E		C	
c - The water pipes and the spray jets must be set in such a way that they are protected from frost.	C		C		NRC		E		E		C	
d - The damming device(s) must be set outside the shaft-top building in such a way that they can be operated at any time. They must be marked by means of an instruction plate.	C		C		NRC		E		E		C	

(1) = in the case of electric cables and leads, and compressed-air lines; no methane-drainage pipes in service.

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Nether-lands	
	1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966	
2. - <u>Fires in Downcast Shafts</u> a - <u>Immediate measures</u> - It is essential to indicate in the fire-fighting plan the maximum amount of water which can be sent down each of the downcast shafts, without creating additional dangers for the workers by its effects on the ventilation.	A(1)		A(3)		E		E		E		E	
- The damming device which can be operated at this stage must not release more than this prescribed quantity of water.	A(2)		A(3)		E		E		E		E	
- Until the leader of the rescue operations has issued his instructions and as long as there has been no reversal of ventilation, water may be sent down only by opening the damming device prescribed for this purpose. b - <u>Measures to be taken on the instructions of the leader of rescue operations</u>. - The leader of the rescue operations must therefore decide - taking into account all the circumstances - either to send down an increased quantity of water - or he must give orders that reversal of the ventilation be brought about or encouraged.	A(3)		A(3)		E		E		E		E	
- To facilitate the reversal of the ventilation in the burning downcast shaft, once this has been opened and the main fan stopped, water can be sent down the upcast shaft.	C		C'		E		E		E		C	
- If reversal of the ventilation has already occurred - either as a result of the upward current produced by the heat of the fire or deliberately - downcast shafts should be treated as though they were upcast shafts.	C		C'		E		E		E		C	
- If the calculated water quantity appears to be too small to extinguish the fire immediately, or to hinder its spread, additional precautions must be worked out and laid down in the fire-fighting plan.												

(1) = there are doubts as to the practicability of the Recommendation; minimum water quantities are laid down.
(2) = there are doubts as to the practicability of the Recommendation.
(3) = not suitable for inclusion in regulations.

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Nether-lands	
	1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966	
- simultaneous supply of water down all downcast shafts	A(1)		A(1)		E		E		E		E	
- partial shutting-off of the burning shaft at surface level.	A(2)		A(2)		NRC		E		E		E	
- Shut underground fire-doors etc.	A(2)		C		E		E		E		E	
3. - <u>Fires in upcast shafts</u> - In upcast shafts water may be sent down only on the instructions of the leader of the rescue operation.	C		C		E		E		E		C	
- As long as there are still any workers in the pit, only so much water may be sent down as will allow the fumes of the fire to continue to be extracted whilst the water is falling.	C		C		E		E		E		C	
<u>Note</u>. A commentary and examples (with diagrams), regarding the calculation of the effect of falling water on the ventilation are given in the Second Report of the Commission, pp. 29-50. III - <u>Recommendations for the sealing-off by dams of mine fires and underground combustion. (Second Report of Safety Commission, p. 53)</u> <u>Introductory remark</u>. The following Recommendations are not binding. They are not intended to give Inspectorates "ready-made" regulations; on the contrary, it remains for the responsible authorities to decide how these Recommendations are to be applied as regulations, circulars or service instructions. These Recommendations refer only to the actual fighting of the fire or combustion; they do not refer to the measures to be taken as a matter of priority to rescue men following the outbreak. A. When a mine fire has broken out or underground combustion developed it is indispensable to take the necessary preparatory steps for any later sealing-off by dams which may be necessary while the direct fire-fighting operations are still going on.	C		C		NRC		C'		C'		C	
In the event of sealing-off by dam becoming necessary, as a general rule the first stoppings to be erected must be advance dams.	C		C		NRC		C'		C'		C	

(1) = not suitable for inclusion in regulations.
(2) = not suitable for inclusion in regulations; must be decided separately in each case.

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Nether-lands	
	1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966	
These advance dams are in fact the real subject of the present Recommendations. B. <u>Structure and erection of the advance dams</u>. 1. <u>If there is no risk of explosion</u> (1): a - to make the advance dams themselves as impermeable as possible and to create the closest possible seal between the dam and the surrounding walls;	C		C		NRC		C'		E		C	
b - there is nothing against shutting off first of all the intake air.	C		C		NRC		C'		E		C	
2. <u>If there is a risk of explosion</u>: a - to have at all times the most precise information possible regarding the degree of explosion risk in the fire zone;	C		C		NRC		C'		E		C	
- it may e.g. be necessary to provide the men with fireproof clothing;	C		C		E		C'		E		C	
b - to ensure that the advance dams are as impermeable as possible, and strong enough to resist an explosion;	C		C		NRC		C'		E		C	
c - to ensure that for the entire period during which the stopping is being erected, there is sufficient ventilation of the fire zone to counter as far as absolutely possible the formation of an explosive gas mixture.	C		C		NRC		C'		E		C	
d - to ensure that all suitable measures are taken to reduce as far as possible the effects of any explosion which may occur; (dustbarriers, stone-dusting or water trough barriers);	C		C		NRC		C'		E		C	
e - if at all possible, the dams on the intake and return sides should be finally sealed simultaneously;	C		C		NRC		C'		E		C	
- only the number of workers and officials strictly necessary for this work should stay behind;	C		C		NRC		C'		E		C	

(1) for the assessment of this risk, see Chap. A - II a), p.

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Netherlands	
	1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966	
- as soon as the dams have been sealed, the danger area must be completely evacuated.	C		C		NRC		C'		E		C	
C. The final dams must be durable, built of brick or concrete under the protection offered by the advance dams.	C		C		NRC		C'		E		C	
Note: Complementary details to the foregoing Recommendations are given in a Commentary (Second Report of the Commission, pp. 53/58).												

II. HUMAN FACTORS

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Netherlands	
	1.1.1966		1.1.1966		1.1.1966		1.1.1966		1.1.1966		1.1.1966	
A. Recommendations regarding medical examination (Second Report of the Commission, p. 79).												
I - Pre-Entry Medical Examinations												
- All applicants for employment at collieries should undergo a pre-entry medical examination.	C		C		C		C		C		C	
- This must establish that the applicant shows no symptoms rendering him unfit for such employment.	C		C		C		C		C		C	
The pre-entry medical examination must include : - a general examination - such special examination as may be deemed necessary for the purpose.	C		C		C		C		C		C	
- The examinations effected must include, as regards the chest, a radiograph or radiophotograph of format not smaller than 70 x 70 mm	C		C		C		C		E		C	
- the latter to be supplemented if need be by a standard-format (1 : 1) radiograph.	C		C		C		C		E		C	
- The nature of these examinations and	C		C		C		C'		E		C	
- the practical details	C		C		C		C'		E		C	
- together with the criteria on which the doctor should base his findings,	C		C		C		C'		E		C	
- should be defined by medical experts.	C		C		C		C'		E		C	
- In the case of recruitment for work, whether below or above ground where the worker will be exposed to a dust hazard, the examination must show a normal pulmonary image.	C		C		C		C'		E		C	
- The "normal pulmonary image" must be defined by medical experts.	C		C		C		C'		E		C	
- These are to be regarded as minimum recommendations. - The points concerning the number and type of examinations to be carried out, - the effecting of radiological examinations - the definition of the normal pulmonary image - can be subjected to review in each country												

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Nether-lands	
	1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966	
- to the extent that this is felt to be appropriate in the light of developments in working conditions and												
- progress in preventive measures.												
II - <u>Special Examinations</u>												
1. The object of special medical examinations should be to establish - taking into account, according to circumstances,												
- the opinions of the training,	C		C		NRP		C'		E		C	
- vocational-guidance and applied psychology	C		C		NRP		C'		E		C'	
- and other services concerned a worker's fitness for certain specific occupations.	C		C		NRP		C		C		C	
2. Such examinations are essential in the case of jobs												
- which either in themselves or owing to the conditions under which they are performed involve a special hazard to the worker himself or to others as regards health and/or safety,	C		C		NRP		C		C		C	
- or which demand particular physical aptitudes or characterological qualities.	C		C		NRP		C		C		C	
3. No attempt has been made to list in full the cases in which special examinations are necessary, this being left to the competent authorities in each country. Examples include:												
- winding enginemen;												
- staple-pit enginemen;												
- motormen (drivers of locomotives, mobile haulers and surface vehicles);												
- workers assigned to hot workings;												
- all those employed on cage handling.												
III - <u>Routine Examinations during employment</u>												
A - <u>Periodic health checks</u>												
- The object here is to establish whether the subject is still fit for duty,	-		CE		C		C		C		C	
- to detect any symptoms of occupational disease at the earliest possible stage,	-		C		C		C		-		C	
- where appropriate to help supervise the subject's health generally.	-		C		C		C		-		C	

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Netherlands	
	1.1.1966		1.1.1966		1.1.1966		1.1.1966		1.1.1966		1.1.1966	
- All personnel should undergo such check-ups at intervals.	CE (1)		CE (1)		C		C		C		C	
- The interval should be fixed at two years.	C		CE		C		C (3)		C (5)		C	
- This interval is reduced for workers under 21.	C		CE		C		C (4)		C		E	
- The interval named above should be considered as a maximum figure.	C		- (2)		- (2)		C		C		C	
This interval can also be reduced:												
- if the state of health of a worker indicates that such a reduction is desirable;	C		C		C		C		E		C'	
- in connection with the type of work performed	C		C		NRP		C		E		C	
- because of the nature of the place at which he works	C		C		NRP		C		E		C	
B - <u>Medical Examinations on specific occasions</u>												
1. <u>Prior to reassignment</u>												
- Workers whom it is proposed to assign to jobs involving hazards not previously taken into account for the man concerned should be re-examined.	C		CE		NRP		C		E		E	
2. <u>Medical examination following absence from work</u>.												
- Where a man's return to work after an illness or accident involves risk to the safety of himself or others, he may be subjected to a special examination, for his own safety or that of others,	C		C'		NRP		NRP + C'		E		C'	
- the type and extent of the examination should be fixed in each case according to the circumstances.	C		C'		NRP		C'		E		C'	

(1) = fulfilled for underground workers; fulfilled only for certain categories of surface workers.
(2) = not applicable.
(3) = the interval is one year.
(4) = for workers below 18 years of age.
(5) = article 648 of Inspectorate Regulations provides for an interval of 1 year.

B. REGULAR REPORT ON MEASURES BASED ON RECOMMENDATIONS OF THE PRESENT, THIRD REPORT

To ensure a certain degree of uniformity with regular reports on the measures taken, the following survey also shows - as mentioned under C I - the situation at 1.1.66, but does not list those Recommendations which are met by appropriate modification of the regulations and can therefore be indicated by the letters used for the purpose. It does, however, list those which cannot be directly implemented by means of regulations or laws. These latter call for other modes of application.

The situation with regard to implementation of the last-mentioned Recommendations and Proposals is indicated, with appropriate notes, in the proper place in the following tables.

In the case of these Recommendations it is again satisfying to note that all the coal-producing countries of the Community have, in almost all cases, taken those steps - or are about to do so (NRP) - which were considered by the Mines Safety Commission to be desirable to improve safety in mines.

Regular report on the implementation of the Conference's Recommendations (continuation I)

I. TECHNICAL ASPECTS

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Nether-lands	
	1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966	
I - Recommendations regarding the protection of underground electrical networks against fire and firedamp - explosion risks (Doc. 1151/61/4).												
1. Recommendations regarding the protection of underground electrical networks against fire risk.												
A. First order precautions - elimination of fire risk.												
1. Prevention of excessive heating of cables in normal use by providing adequate conductivity. Prevention of unforeseen local heatings by the use of suitable designs and by proper supervision.	C		C		C		C		C'		C + NRP	
2. Prevention of the occurrence of faults and short-circuits between conductors, or between conductor and earth, by adequate insulation or proper spacing of the conductors.	C		C		C		C		C'		C + NRP	
B. Second order precautions - protection against the effects of a heating or a fault.												
1. Use of heat-stable insulations.	C		C		C		NRP		C'		C + NRP	
2. Use of protective sheathing for equipment and for cables, made of flame-resistant and non-propagating material.	C		NRC + E		NRP		C(1)		C'		C + NRP	
Use of oil as a non-conductor only if no fire risk for the workers is involved.	C		C		NRP		C		C'		C + NRP	
3. Accumulations of flammable or combustible materials and of pipelines for combustible gases should be sited well away from electrical equipment.	C + NRP		C + C'		C		C' + NRP		C'		C + NRP	
C. Third order precautions - effects on the network.												
1. Automatic protection of circuits against overloads.	C		C		C		C		C'		C + NRP	
2. Automatic protection of circuits against short-circuit; these protective devices must be capable of handling the maximum short-circuit voltage at their point of installation.	C		C		C		NRP		C'		C + NRP	
Selection and use of such devices allowing for the minimum short-circuit voltage which can occur at the end of the section they protect.	C		C		C		NRP		C'		C + NRP	

(1) - with respect to armoured cables.

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Netherlands	
	1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966	
3. Steps to give effective protection against faults with low voltages, which might get past the above-named protective devices and cause dangerous heatings.	NRP		?(1)		NRP		C		C'		C' + NRP	
2. <u>Recommendations for the protection of underground electrical networks against firedamp-explosion risks</u>. A. <u>First order precautions - prevention of accumulations of firedamp</u>. 1. The firedamp content at the site of the electrical apparatus must be kept within the limits prescribed by the Inspectorate.	C		C		C		C		C'		C	
2. The ventilation situation must be checked before any new installation or extension of electrical equipment.	C		C		C		C		C'		C' + NRP	
3. There must be a thorough investigation of the possible consequences of any alterations in working method, ventilation or gas emission, which might cause problems in the vicinity of electrical equipment.	C		C		NRP		C		C'		C'	
B. <u>Second order precautions - prevention of ignition</u>. 1. In gassy workings: use of electrical equipment which is permitted by the Inspectorate only under its own specified conditions.	C		C		C		C		?		C + NRP	
2. The electrical equipment must be installed, used and maintained in such a way as to keep it flame-proof.	C		C		C		C		C'		C + NRP	
All cables must be of adequate mechanical strength.	C		C		C		C		C		C + NRP	
All cables must be installed and maintained without damage.	C		C		C		C		C'		C	
C. <u>Third order precautions - cutting off the circuit</u>. 1. Networks must be installed in such a way that any fault current which may arise between phase and earth is reduced to a low value or quickly cut off.	NRP		C		NRP		C		C'		C + NRP	
2. A protective relay, preferable automatic, must be provided against between-phase faults and earth faults.	NRP		C(2)+ NRP		NRP		C		C'		C' + NRP	
3. Precautions must be taken to avoid accidents when faults are being sought or dealt with.	C		C(2)+ NRP		NRP		C		C'		CC' + NRP	

(1) = no suitable devices for the determination of these faults available.
(2) = occur with movable machines.

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Netherlands	
	1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966	
4. Protection must be given to leads without metallic sheathing, and to those which supply movable machines, by means of screens which bring a protective device into operation if a fault occurs.	C		NRC		C + NRP		C		C'		C' + NRP	
5. If the firedamp content rises above the prescribed limit all the sections of circuit involved must be cut off.	C		C		C		C		C'		C	
Issuing instructions to maintain in operation certain machines which provide ventilation.	C		C		C		C		C'		C + C'	
Restarting only when the firedamp content has fallen below the permissible value, and only on the orders of a trained person.	C		C		NRP		C		C'		C + NRP	
<u>Supplementary precautions for pits liable to sudden outbursts of gas</u>.												
1. <u>Risk of damage by particles projected by an outburst of gas</u>.												
- The threatened zones in which projection can occur should not be electrified.	A		C		NRP		C(1)		A(2)		A	
- The electrical equipment and cables should be protected against heavy blows.	A		C		C		C		A(4)		C	
- The electrical equipment should be designed to give maximum robustness.	A		C		C		C		A(4)		C	
2. <u>The risk of firedamp concentrations</u>.												
- Increased ventilation.	C'		C'		C'		C		A(4)		C	
- Use of remote-indicating methanometers or ventilation-fault detectors which can cut off the threatened section of the circuit.	C'		E(3)		E		C		A(4)		C' + NRP	
- Relaxation shot-firing only after all equipment has been switched off.	C'		C'		NRP		C		A(4)		-	
3. <u>Supplementary electrical precautions</u>.												
a) Preferable use of a starpoint earthed via a strong impedance, e.g. by means of an insulation detector.	C		C		NRP		NRP		A(4)		NRP	
b) Quickest possible automatic protection of the network against all insulation faults, even if formed by resistances between phase and earth.	NRP		C + NRP		NRP		C		A(4)		C + NRP	

(1) = the use of electricity is forbidden in pits liable to sudden outbursts of gas, excepting for lighting and shot-firing. Exceptions can however be approved by the senior mining engineers: when using armoured cables, telephone installations and remote-indicating methanometers in intake airways - provided that no damage is likely to occur as a result of a gas outburst - and also in main return airways.

(2) = no pits liable to sudden outbursts of gas.

(3) = already implemented in individual cases.

(4) = the opening-up of fire areas is carried out on the responsibility of the mine-owner, who prepares a reopening plan - taking into account the scale and type of fire and the ventilation situation in the fire area - in collaboration with the Main Rescue Station. The action plans of the Main Rescue Stations very largely embody the principles laid down in Doc. 1304/3/64.

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Nether-lands	
	1.1.1966		1.1.1966		1.1.1966		1.1.1966		1.1.1966		1.1.1966	
II - <u>Principles for the opening-up of sealed-off fire areas.</u> <u>(Doc. 1304/3/64)</u> I - <u>GENERAL</u> Special reasons for opening-up a district sealed-off after a fire: - Recovery of bodies - Salvage of material - Recovery of roadways and workings - Reduction of the sealed-off area - Inspection of the district and, if necessary, - direct fire-fighting. The following hazards can arise from reopening a sealed-off district: - Release of CO, foul air and hot damp air - Explosion of firedamp or fire gas, where the fire is not yet extinct - Recrudescence of the fire. Recrudescence of the fire can occur only when fresh air reaches the seat of the fire, so that with all operations involved in reopening a fire area it is of prime importance to inspect the individual air currents constantly.	C		C		C		(1) C'		C'		NRP	
All places suspected of having been seats of fire or heatings must be ascertained with the utmost speed.	E		C'		C'		C'		C'		C'	
II - <u>BASIC RULES</u> Sealed-off districts may be reopened only after the competent authorities have been notified or have given their permission.	C		C		C		C(2)		C'		C'	
Before opening commences, gas samples must be taken from the fire area, at each stopping and from all sampling pipes.	C		C		C		C'		C'		C'	
The gas samples are analysed and the results assessed from the point of view of explosion risk and the state of the seat of the fire.	C		C		C		C'		C'		C'	

(1) = The opening-up of fire areas is carried out on the responsibility of the mine-owner, who prepares a reopening plan - taking into account the scale and type of fire and the ventilation situation in the fire area - in collaboration with the Main Rescue Station. The action plans of the Main Rescue Stations very largely embody the principles laid down in Doc. 1304/3/64.

(2) = applies only to the opening-up of fire areas <u>after</u> particularly large fires.

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Netherlands	
	1.1.1966		1.1.1966		1.1.1966		1.1.1966		1.1.1966		1.1.1966	
The cooling-off time of the seat of the fire must be taken into account.	E		C		C'		C'		C'		C'	
If possible, the sealed-off district should be inspected before any air is circulated or any operations are started.	A		C'		C'		C'		C'		C'	
Before opening commences, a plan should be drawn up jointly with the Main Rescue Centre.	C		NRC		C'		C'		C'		C'	
This plan must cover the following points in writing: - the method, - nature, scope and order of operations, - direction and supervision, - checking of the ventilation system and of the composition of the air, - communications, - preparation of material, - evacuation, prohibition of access to and remanning of endangered workings, - deployment of the Rescue Team, - connection and disconnection of electrical equipment and isolation from the supply of electricity, - opening and closing of the compressed-air, water and methane-drainage pipeline valves, - re-sealing of the fire area in emergency.	C		C		C'		C'		C'		C'	
The method to be adopted for re-opening sealed-off districts depends on the presence or otherwise of - non-explosive gaseous mixtures which remain non-explosive on dilution with air - gaseous mixtures which may become explosive on dilution with air, or - explosive gaseous mixtures. Fire areas may be opened at one point only or at several points. In the latter case a continuous direct circulation of air is established and the fire area is permeated with fresh air. An examination should be made of the effects of the opening of the area on the ventilation system of the pit as a whole and within the fire area.	C		C+C'		C'		C'		C'		C'	

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Netherlands	
	1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966	
A sealed-off district can be re-opened by - breaching one or more stoppings (with or without the use of an air-lock), or - cutting a new entry into the fire area. Before opening a sealed-off area, provision should be made for immediate reclosure if necessary.	C		C		C		C'		C'		C'	
Stoppings may be opened only on the instructions of the manager and under the constant supervision of personnel appointed by him.	C		C		C'		C		C'		C'	
Workings, into which the opening of a stopping may release toxic gases or foul air, or where there is a risk of explosion, must be evacuated and put out of bounds to personnel before opening.	C		C		C'		C		C'		C	
Since conditions in the district, the state of the seat of the fire and the risk of gas explosion may change during the opening operation, the composition of the fire gases or fumes must be checked at regular intervals.	C		C		C		C		C'		C'	
The kind and number of samples and the points at which they are to be taken should be fixed in advance.	C		C		C'		C'		C'		C'	
In doing so, the possibility of gas accumulations forming should be allowed for. (In general, the formation of gas layers is fostered by low air velocities and differences in temperature.)	C		NRC		C'		C'		C'		C	
Where a stopping is opened in the knowledge that the fire is not yet extinguished, or where the fire is revived as a result, the area in question must be resealed at once, if the composition of the fire gases or fumes changes in such a way that an explosion hazard might arise.	C		C		C		C'		C'		C'	
With non-explosive gas mixtures in the fire area, this is necessary only if extinguishing operations seem unlikely to succeed.	C		C'		C'		C'		C'		C'	
It is the responsibility of the Rescue Team to open and inspect fire areas, even after they have been ventilated.	C		C		C'		C'		C'		C'	
On the intake side, breaching of stoppings need not be carried out by the Rescue Team provided that no gas hazard is to be reckoned with.	C		C'		C'		C'		C'		C'	

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Nether-lands	
	1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966	
When deploying in the Rescue Team, allowance should be made for the adverse climatic conditions which are likely to obtain at any point where they may be employed.	C		C		C'		C'		C'		C	
III - <u>OPENING-UP SEALED-OFF DISTRICTS CONTAINING NON-EXPLOSIVE GAS MIXTURES</u> 1. <u>Opening-up on one side only</u>. A sealed-off district containing non-explosive gas mixtures may be opened on one side even if the fire is not yet extinguished. It must first be established whether the remaining stoppings and seals are sufficiently air-tight and that there is no risk of releasing fire gases, in particular carbon monoxide, in other parts of the working, which may be connected with the fire area.	C		C		C'		C		C'		C'	
If the stopping to be opened is on the return side, special attention should be paid to the release of CO or of foul air.	C		C'		C'		C		C'		C'	
The decision as to whether to carry out the operations in the fire area without ventilation air or with auxiliary ventilation depends on the purpose of the re-opening of the area, the expected duration of the Rescue Team's operations and the possible hazards involved. Auxiliary ventilation is especially desirable for extended operations within the fire area. a) Working without ventilation air, especially behind an air-lock, has the advantage of eliminating the risk of reviving the fire. When carrying out extinguishing operations without ventilation air and under unfavourable climatic conditions, it is advisable first to set up water sprinklers and to put these into operation only after the Rescue Team has left the fire area.	C		C		C'		C'		C'		C'	
b) If auxiliary ventilation is used, it should preferably be by suction.	C		A(1)		C'		C'		?(2)		C'	
It is advisable to isolate the area ventilated by an auxiliary fan from the non-ventilated section by means of an auxiliary stopping if the seat of the fire is situated in the non-ventilated section.	C		C		C'		C'		C'		C'	

(1) = Experience hitherto has shown that blowing auxiliary ventilation is preferable, to ensure that no explosive gases are aspirated by the auxiliary fan.

(2) = The use of blowing auxiliary ventilation is preferred.

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Netherlands	
	1.1.1966		1.1.1966		1.1.1966		1.1.1966		1.1.1966		1.1.1966	
2. Opening on two sides to establish a circulation of air round the fire area. A fire area containing non-explosive gas mixtures may be ventilated only if it is likely that the fire is extinct.	C		C		C'		C'		C'		C'	
As soon as ventilation is established, a Rescue Team wearing breathing apparatus may enter the fire area to examine conditions within it and to extinguish any fires.	C		C		C'		C'		C'		C'	
IV - REOPENING OF SEALED-OFF DISTRICTS CONTAINING GAS MIXTURES WHICH MAY BECOME EXPLOSIVE ON DILUTION WITH AIR. 1. Opening on one side only A fire area containing gas mixtures which may become explosive on dilution with air may be opened on one side, even if the fire is not yet extinguished. It is however, essential to install a tight airlock in front of the stopping to be opened, so as to ensure an effective air seal.	C		C		C'		C'		C'		C'	
It must first be checked whether the remaining stoppings and seals are sufficiently airtight and that there is no risk of releasing fire gases, in particular carbon monoxide, into other parts of the workings which may be connected with the fire area.	C		C		C'		C'		C'		C'	
If the stopping to be opened is on the return side, particular attention must be paid to the possibility of releasing CO, CH_4 or foul air.	C		C		C'		C		C'		C'	
All operations must be carried out without ventilation air.	C		C		C'		C		C'		C'	
There must be continuous sampling and evaluation of the results of analysis to check whether the gas mixture remains non-explosive.	C		C		C'		C		C'		C'	
For extinguishing operations, see note in III - 1. If the size of the sealed-off area is to be reduced, a new explosion-proof stopping must be erected.	C		C		C'		C'		C'		C'	
In order to be able to erect this stopping under tolerable climatic conditions and possibly without wearing breathing apparatus, auxiliary ventilation may be provided. For this purpose, an auxiliary stopping must first be erected and sealed in an unventilated atmosphere. (Before constructing the main stopping, it should be considered whether to erect several successive auxiliary stoppings, according to the possible hazards.)	C		C		C'		C'		C'		C'	

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Netherlands	
	1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966	
The section of roadway thus recovered must then be ventilated by an auxiliary fan so as to create a suitable climate for the erection of the main stopping.	C'		C		C'		C'		C'		C'	
When starting up the auxiliary ventilation it must be remembered that the gas mixture becomes explosive on dilution with air. It is therefore essential to ensure that there is no source of ignition in the workings to be ventilated.	C		C'		C'		C'		C'		C'	
In addition, it is essential to make certain that the fan used cannot cause any risk of ignition.	C		C		C'		C'		C'		C'	
Before starting up the auxiliary ventilation, all workings likely to be exposed to the hazards of fire gases or explosions must first be evacuated and access thereto prohibited.	C		C		C'		C'		C'		C'	
Electrical equipment must be cut off from the power supply.	C		C		C		C'		C' (1)		C'	
In addition, the ventilation must, as far as possible, be regulated so that no explosive gas mixtures can be released over long distances.	C		C		C'		C'		C'		C'	
For this purpose, the quantity of air circulated should, if necessary, be increased.	C		C'		C'		C'		C'		C'	
2. Opening on two sides to establish a circulation of air through the fire area. This method of opening automatically results in the formation of a through air-circuit in the open district, but not necessarily in all air-circuits in the fire area. The method can be used only if there are no remaining signs of fire in the district.	C		C		C'		C'		C'		C'	
In addition, a period long enough for the seat of the fire to cool off must have elapsed since the supposed time of extinction.	C		C		C'		C'		C'		C'	
If possible, the Rescue Team should carry out an inspection in an unventilated atmosphere.	A		C		C'		C'		C'		C'	
Failing this, the results of the snuffle pipe tests should be used to determine the condition of the seat of the fire.	C		C		C'		C'		C'		C'	
Furthermore, it should be considered in such cases whether the method described in section IV -1 might not be preferable.	E		- (2)		C'		C'		C'		C'	

(1) = Special attention is drawn to the fact that the fan must be switched off.

(2) = Not applicable.

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Netherlands	
	1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966	
In each case, it is essential to check the likelihood of a recrudescence of the fire during ventilation, by means of fire gas samples.	C'		C		C'		C'		C'		C'	
This is particularly important where a fire area has a much-branched ventilation system.	C'		C'		C'		C'		C'		C'	
Before ventilating the fire area, all workings exposed to the hazards of fire gases or explosions of fire gases or firedamp when the stopping is opened must be evacuated.	C		C		C'		C'		C'		C'	
All electrical installations in these workings must be cut off from the power supply.	C		C		C		C'		C'		C'	
On safety grounds, it is advisable to open the return stopping first.	E		C		C'		C'		C'		C'	
After the Rescue Team has withdrawn to less dangerous zones, the intake stopping should be opened.	E		C		C'		C'		C'		C'	
When ventilating the fire area, the quantity of air and the content of inflammable gases in the air-current circulating through the fire area, and in the current into which it subsequently flows, should be checked.	C		C		C'		C'		C'		C'	
The two air currents should be mutually adjusted in such a manner as to ensure that no explosive mixture of gases is present over long distances after their junction.	C		C		C'		C'		C'		C'	
Access to the fire area during ventilation is prohibited.	C		C		C'		C'		C'		C'	
V - OPENING OF FIRE AREAS CONTAINING EXPLOSIVE GAS MIXTURES												
Sealed-off districts may not be reopened, either on one side or on two sides, if the presence of explosive gas mixtures behind the stoppings is established.	C		C		C'		C'		C'		C'	
VI - OPENING OF FLOODED FIRE AREAS												
The composition of the air in fire areas flooded to extinguish the fire must be checked after draining.	C		C'		C'		C'		C'		C'	
In workings with solid coal, allowance must be made for the increased hazard of spontaneous ignition after drainage. Where fire areas have been isolated by local flooding instead of by stoppings, the rules mentioned in sections I to V should be observed insofar as applicable.	C		C'		C'		C'		C'		C'	

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Netherlands	
	1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966	
VII - <u>REMANNING OF FIRE AREAS</u> After ventilating a fire area, workings may not be manning until a Rescue Team has established that all workings are free of noxious gases.	C		C		C'		C'		C'		C'	
If the fire area is merely being reduced in size, workings free of noxious gases may be manned only when the remainder of the fire-area has been sealed-off by permanent stoppings.	C		C		C'		C'		C'		C'	
III - <u>Principles for the construction of advance fire stoppings from plaster (Doc. 4928/63/2)</u> In all cases where it is possible and advantageous, the erection of plaster stoppings to seal off fires and heatings is justified. Is this process applied in practice as laid down in the principles contained in the Report?	NRP		No(1)		Yes		(2) Yes		E		E	
Is the application of this process prescribed by regulations?	NRP		No		No		No		E		E	
Is this process applied in practice in a manner differing from the principles laid down?	NRP		No		No		No		E		E	
Is the application of this modified process prescribed by regulations?	NRP		No		No		No		E		E	
IV - <u>Second Report on Specifications and testing conditions relating to fire-resistant fluids used for power transmission. (Doc. 700/2/63)</u> <u>Part II - Specifications of test conditions (pp. 12 onwards)</u> <u>Article 1 - Conditions of approval</u> 1. Fire-resistant fluids for hydraulic power transmission and hydraulic control, before being used in mine workings, must be given a certificate of approval.	C		NRC		C'		C'(3) + E(4)		E		E	
Consequently, the product must undergo the following tests: a) Laboratory tests (Articles 3-7) aa) To determine technical criteria of flammability (Article 3 - p. 15)	C		NRC		C'		C'E		E		E	
ab) To determine health criteria (Article 4 - p. 16)	C		NRC		C'		C'E		E		E	
ac) To determine technical criteria (Article 5 - p. 16)	C		NRC		C'		C'E		E		E	

(1) = Tests with wet-flushed fly-ash dams are to be made, instead of plaster stoppings, which will be tested subsequently.

(2) = The choice of means is however left to the mine-owner.

(3) = In the Charbonnages de France register, the Safety Commission Recommendations have been taken into account.

(4) = The question of preparing a new regulation is being examined by the responsible authority.

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Nether-lands	
	1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966	
b) Long-term tests during practical operations (Article 8 - p. 24)	C		C'		C'		C'E		E		E	
2. These tests are carried out under a specialist institute.	(1) C+C'		NRC		C'		C'E		E		E	
3. Approval for use underground is dependent on presentation of the certificate mentioned in 1.	C		NRC		C'		C'E		E		E	
.... <u>Article 9 - Withdrawal of approval</u> At the request of the specialist institute, the permitting authority may withdraw the approval for the fluid to be used in mine workings.	C		NRC		NRP		C'E		E		E	
.... V - <u>Report on the Electro-magnetic examination of winding ropes. (Doc. 8470/64/2)</u> Steps taken to develop the electro-magnetic testing method and results obtained.	(2) C'		(3) -		(2) C'		(2)+ (4) C'		?		C'	
VI - <u>Report on the use of accelerometers to test winding installations. (Doc. 3725/1/61, p. 9) (German text)</u> Tests with accelerometers should be continued on a large scale.	C'		(5) -		-		-		?		C'	
Use of accelerometers should be extended.	C'		(5) -		-		-		?		C'	
VII - <u>Recommendation regarding the provision of advice from foreign experts in the case of major accidents. (Doc. 4364/61/3)</u> Advice by the leaders of the rescue operation by qualified foreign experts in mine-rescue matters. The heads of the Main Rescue Station are provided for this purpose with a plan containing the most important addresses and information needed.	(6) C'		(6) C'		(6) C'		(6) C'		(7) A		(6) C'	
This plan should be constantly maintained up-to-date.	(6) C'		(6) C'		(6) C'		(6) C'		(7) A		(6) C'	

(1) = for the execution of the long-term tests.

(2) = Tests to improve electro-magnetic testing are underway.

(3) = Measurements are taken in individual cases.

(4) = Electro-magnetic testing is required in certain exceptional cases in the General Mines Regulations.

(5) = Tests carried out in individual cases.

(6) = The Main Rescue Stations are in touch with the Main Rescue Stations in the Community countries.

(7) = Not applicable in the Sulcis coal-field.

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Netherlands	
	1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966	
VIII - <u>Report on firedamp-proof electrical equipment for nominal voltages above 1,100 volts. (Doc. 2400/64/11)</u> 1. What use is made of the information in this report, and, in particular, to whom was it distributed? 2. The Working Party has laid down that in the Community countries research into the development of low-oil or oil-less H.T. switchgear having the correct characteristics for use in gassy pits should continue. What is the position regarding continuation of this research and what data have been obtained to date?	Since only new low-oil or oil-less switchgear is being used up to the present, no special use has been made of the information. Consequently, no further research is being carried out.		The information has been distributed to the department responsible for electrical equipment at the Technical Supervision Centre for Mining Equipment. No such research in the Saar.		The Report was published in "Annales des Mines". There are sufficient devices with satisfactory characteristics for use under specified conditions of use. NRP with regard to approval of these HT Switchgear Units.		NRP - Revision of the General Regulations regarding use of electricity underground, especially in gassy and dusty pits, is in hand.		Normal voltages over 1,100 Volts forbidden.		NRP - Brought to the notice of all pits.	
3. The Working Party has noted that oil is being used in respect of relays, and that research would be needed to reduce or eliminate the use of oil. What research is being carried out to this end?	(1)		(2)		?		(3)		(3)		(2)	
4. This Report notes that switchgear specialists are trying to use less - or even no - oil with voltages above 1,100 volts and that in particular oil-less switchgear with separate poles, and low-oil switchgear, were being more and more widely used in most countries, at least for new plant. These observations were deduced from practice during 1960 - 1962. What developments have occurred since then?	(4)		(5)		(6)		(3)		(3)		(5)	

(1) = trials with oil-less relays are under way.

(2) = no research of this kind in hand.

(3) = see above.

(4) = this trend continues.

(5) = not applicable.

(6) = in certain circumstances these devices will also be used in Belgium after the promulgation of the new regulations.

II. HUMAN FACTORS

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Netherlands	
	1.1.1966		1.1.1966		1.1.1966		1.1.1966		1.1.1966		1.1.1966	
Recommendation in the fixing of climatic limits. (The unabridged text is reproduced in Document 3034/4/62).												
1.1 The basis is the American effective temperature (° eff basic scale).	C		C		C'		A		E		C	
Air velocities above 3 metres/sec should be considered as only 3 metres/sec in determining the American effective temperature.	C(1)		C		C'		-		E		C	
1.2 The temperature dates must be given so as to make possible a comparison on the basis indicated under 1.1.	C		C		C'		-		E		C	
1.3 The climatic limits determined shall be maximum values.	C		C		-		-		E		C	
Better climatic values for the workers remain unchanged.	C		C		-		-		E		-(2)	
1.4 There should be further investigation into the suitability and corrections of the various climatic indices.	?		-		-		-		E		-(2)	
2. Determination of a maximum climatic value.												
2.2 Work or location is forbidden in working places where the temperature exceeds 32° eff A (basic scale), excepting the cases named in 2.3 and 2.4.	C		C		-		(3)		E		C	
2.3 An exception can be made to the ban on working on location in temperatures above 32° eff A (basic scale) if the responsible authority has given permission and the workers in question have been medically examined.	C(4)		C		-		A		E		C	
In this case the following conditions must be fulfilled:												
2.3.1 The responsible authority can only issue permission for a fixed period and for given working operations.	C		C		-		A		E		C	
2.3.2 The work must be carried out under medical supervision.	C		C(5)		-		-		E		C	
Principles must be worked out, in collaboration with medical experts, covering the medical supervision and the examination envisaged under 2.3.	C		-		-		-		E		C	
2.3.3 Work must not continue uninterrupted for more than one hour. A suitable break must then be arranged in a better "climate".	C		C		-		A		E		C	
The duration of uninterrupted working time, as well as												
- the duration and frequency of the breaks and												

(1) = 3,5 m/s.

(2) = not applicable.

(3) = working points where the temperature reaches 28°C are considered as particularly hot (without this being an absolute maximum value).

(4) = for mine rescue personnel.

(5) = the work should be carried out under medical supervision.

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Nether-lands	
	1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966	
- the climatic range in which this break is spent, as also - all other necessary provisions are to be laid down in writing by the Inspectorate together with the responsible doctor before the work begins.	C(1)		C		-		A		E		C	
2.3.4 Acclimatised persons must be chosen.	C		-		-		C		E		C	
Persons over 40 years of age must not be put on this work.	C		-		-		-		E		C	
Persons under 21 and over 45 years of age must not be put to work.	C		C(2)		-		-		E		C	
2.4 An exception can also be made to the ban on working on location in temperatures above 32° eff A (basic scale) if danger threatens or in special circumstances calling for immediate action.	C		C		C'		C(3)		E		C	
In other cases, however: 2.4.1 the responsible authority and the responsible doctor must be immediately informed;	C		C		C'		A		E		C	
2.4.2 the work must be performed as soon as possible under the conditions listed in 2.3.1 to 2.3.4.	C		C		C'		C'		E		C	
3. <u>Climatic range between 32° eff A and 28° eff A (basic scale)</u>							(4)					
3.1.1 Only persons shown by medical examination to be suitable can be employed in this climatic range.	A		C'		-		C		E		C'	
The medical examination must pay particular attention to heart and blood circulation.	A		C'		-		C		E		C'	
Persons continually employed in this climatic range must be examined medically at least once a year.	A		-		-		C		E		C'	
In addition, the following provisions apply: 3.1.2 As soon as a working-point reaches a temperature above 28° eff A (basic scale) the responsible authority must be informed in writing.	A		C(5)		-		A		E		C	
3.1.3 The length of stay in the climatic range between 30° and 32° eff A (basic scale) is restricted to 5 hours, and	A		C(6)		-		A		E		C	
in the range between 28° and 30° eff A (basic scale) to 6 hours.	A		C		C'		A		E		C	

(1) = laid down generally in the mine rescue plans.

(2) = no provision for excluding persons below 21 years of age from exceptional hot work.

(3) = in the case of the ban on work or location in <u>excessively high</u> temperatures ......

(4) = range of climatic conditions above 28°C.

(5) = if 30° eff A (basic scale) is reached or exceeded the Mines Inspectorate must be informed.

(6) = 6 hours.

Recommendations by the Commission	N.R./Wph.		Saar		Belgium		France		Italy		Nether-lands	
	1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966		1.1. 1966	
3.1.4 For work in a climatic range between 28° and 32° eff A (basic scale) a method of payment corresponding to these conditions must be applied to eliminate any overloading.	A		A(1)		-		C'		E		C'	
3.1.5 The provisions quoted in 3.1.3 and 3.1.4 apply to all persons who during one shift have to work more than half the time of that shift in one of the climatic ranges mentioned.	A		C		-		A		E		C'	

(1) = must be arranged by tariff, outside the responsibility of the Mines Inspectorate.

PART FOUR

STATISTICAL DATA ON MINE SAFETY

The Second Report published for the first time common accident statistics, covering the years 1959-1960 and laid out in the manner worked out by the Commission. These statistical tables, together with those for 1961-1964 contained in the present report comprise only underground accidents - presented in a single classification - group accidents being dealt with separately. The number of casualties is in each instance broken down into the same series of twelve causes. In all cases, the only accidents recorded were those which caused the death of the victim within 8 weeks or which prevented the casualty from resuming work underground within 8 weeks. The accident frequency is expressed in each case in terms of accidents per million man-hours. A minimum of five fatalities or injured persons constitutes a standard yardstick for group accidents.

The statistical data are first presented by coal-fields, then by countries, and comprise : total number of persons disabled, total number of fatalities, frequency of accidents causing disablement, frequency of fatalities, number of group accidents, number of persons disabled in a group accident and number of fatalities in a group accident.

Finally, there is a comparative table of the figures for frequency of disablement and of fatalities, and the number and severity (disablement of death) of group accidents.

In working out this standard presentation the Commission considered that it was necessary - bearing in mind the difficulties already encountered in presenting national statistics - to have a simple but clear system in the initial stages. After a period of trial, it would be advisable to see to what extent the standard form would need to be extended or improved.

However, it has been found that there exists a divergence of views as to the true value of the comparison of these common statistics. It is not suitable for the statistical information to be presented in the form then in use.

The Mines Safety Commission has entrusted a Working Party with the task of establishing whether a better degree of comparability can be reached.

A. COMMON STATISTICAL SURVEY OF UNDERGROUND ACCIDENTS IN 1960 (1)

(1) For the common statistics for 1958 & 1959, see Second Report of the Mines Safety Commission, pp. 163 et seq.

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1960
Country: North-Rhine/Westphalia
Coal-field: Ruhr

CAUSE	Number of casualties: Disablements as under (a) below	Number of casualties: Fatalities as under (b) below	Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below: Number of accidents	Group accidents: Number of disablements as under (a)	Group accidents: Number of fatalities as under (b)
1) Falls of ground	2,265	122		4.808	0.259	1	2	4
2) Haulage and transport	1,128	85		2.395	0.180	-	-	-
3) Movement of personnel	1,169	35		2.482	0.074	-	-	-
4) Machinery, handling of tools and supports	462	5		0.981	0.013	-	-	-
5) Falling objects	1,230	21		2.611	0.045	-	-	-
6) Explosives and fumes	4	-		0.008	-	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	2	-		0.004	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	7	1		0.015	0.002	-	-	-
12) Other causes	261	20		0.554	0.042	-	-	-
TOTAL	6,528	289	471,053,408	13.858	0.615	1	2	4

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1960
Country: North-Rhine/Westphalia
Coal-field: Aachen

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	151	15		3.698	0.367	1		6
2) Haulage and transport	113	6		2.767	0.147			
3) Movement of personnel	71	2		1.739	0.049			
4) Machinery, handling of tools and supports	14	2		0.343	0.049			
5) Falling objects	108	-		2.645	-			
6) Explosives and fumes	-	-		-	-			
7) Explosions of firedamp or coal dust	-	-		-	-			
8) Sudden outbursts of firedamp, suffocation by natural gases	-	1		-	0.024			
9) Underground combustion and fires	-	-		-	-			
10) Inrushes of water	-	1		-	0.024			
11) Electricity	-	-		-	-			
12) Other causes	1	1		0.024	0.024			
TOTAL	458	28	40,831,592	11.217	0.686	1		6

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1960
Country: North-Rhine/Westphalia
Coal-field: Ibbenbüren

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties: Disablements as under (a) below	Number of casualties: Fatalities as under (b) below	Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below: Number of accidents	Group accidents as under (c) below: Number of disablements as under (a)	Group accidents as under (c) below: Number of fatalities as under (b)
1) Falls of ground	27	5		2.743	0.507	-	-	-
2) Haulage and transport	17	1		1.727	0.102	-	-	-
3) Movement of personnel	21	1		2.133	0.102	-	-	-
4) Machinery, handling of tools and supports	8	-		0.813	-	-	-	-
5) Falling objects	18	-		1.829	-	-	-	-
6) Explosives and fumes	-	1		-	0.102	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	-	-		-	-	-	-	-
12) Other causes	5	-		0.508	-	-	-	-
TOTAL	96	8	9,843,478	9.753	0.813	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1960
Country: North-Rhine/Westphalia
Coal-field:

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	2,443	142		4.682	0.272	2	2	10
2) Haulage and transport	1,258	92		2.411	0.176	-	-	-
3) Movement of personnel	1,261	38		2.417	0.073	-	-	-
4) Machinery, handling of tools and supports	484	7		0.928	0.013	-	-	-
5) Falling objects	1,356	21		2.599	0.040	-	-	-
6) Explosives and fumes	4	1		0.008	0.002	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	1		-	0.002	-	-	-
9) Underground combustion and fires	2	-		0.004	-	-	-	-
10) Inrushes of water	-	1		-	0.002	-	-	-
11) Electricity	7	1		0.013	0.002	-	-	-
12) Other causes	267	21		0.512	0.040	-	-	-
TOTAL	7,082	325	521,728,478	13.574	0.622	2	2	10

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1960
Country: Saar

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS

AT MINES IN THE E.C.S.C. COUNTRIES

Coal-field:

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	435	13		6.466	0.193			
2) Haulage and transport	182	15		2.705	0.223			
3) Movement of personnel	122	3		1.814	0.045			
4) Machinery, handling of tools and supports	58	-		0.862	-			
5) Falling objects	257	2		3.820	0.030			
6) Explosives and fumes	2	1		0.030	0.015			
7) Explosions of firedamp or coal dust	-	-		-	-			
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-			
9) Underground combustion and fires	-	-		-	-			
10) Inrushes of water	-	-		-	-			
11) Electricity	-	-		-	-			
12) Other causes	2	-		0.030	-			
TOTAL	1,058	34	67,273,201	15.727	0.506			

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1960
Country: Germany
Coal-field: North-Rhine/Westphalia and Saar

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	2,878	155		4.886	0.263	2	2	10
2) Haulage and transport	1,440	107		2.445	0.182	-	-	-
3) Movement of personnel	1,383	41		2.348	0.070	-	-	-
4) Machinery, handling of tools and supports	542	7		0.920	0.012	-	-	-
5) Falling objects	1,613	23		2.738	0.039	-	-	-
6) Explosives and fumes	6	2		0,010	0.003	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	0.002	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	1		-	0.002	-	-	-
9) Underground combustion and fires	2	-		0.003	-	-	-	-
10) Inrushes of water	-	1		-	0.002	-	-	-
11) Electricity	7	1		0.012	0.002	-	-	-
12) Other causes	269	21		0.457	0.036	-	-	-
TOTAL	8,140	359	589,001,679	13.819	0.611	2	2	10

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1960
Country: Belgium

Coal-field: Charleroi-Namur

CAUSE	Number of casualties: Disablements as under (a) below	Number of casualties: Fatalities as under (b) below	Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below: Number of accidents	Group accidents as under (c) below: Number of disablements as under (a)	Group accidents as under (c) below: Number of fatalities as under (b)
1) Falls of ground	154	8		5.121	0.266			
2) Haulage and transport	106	6		3.525	0.200			
3) Movement of personnel	35	-		1.164	-			
4) Machinery, handling of tools and supports	86	-		2.860	-			
5) Falling objects	7	-		0.233	-			
6) Explosives and fumes	1	-		0.033	-			
7) Explosions of firedamp or coal dust	-	-		-	-			
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-			
9) Underground combustion and fires	-	-		-	-			
10) Inrushes of water	-	-		-	-			
11) Electricity	-	-		-	-			
12) Other causes	11	1		0.366	0.033			
TOTAL	400	15	30,070,120	13.302	0.499			

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1960
Country: Belgium
Coal-field: Liège

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	103	5	Including time for inward and outward journeys.	4.280	0.208			
2) Haulage and transport	67	4		2.784	0.166			
3) Movement of personnel	28	1		1.163	0.042			
4) Machinery, handling of tools and supports	32	-		1.330	-			
5) Falling objects	8	-		0.332	-			
6) Explosives and fumes	-	-		-	-			
7) Explosions of firedamp or coal dust	-	-		-	-			
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-			
9) Underground combustion and fires	-	-		-	-			
10) Inrushes of water	-	-		-	-			
11) Electricity	1	-		0.042	-			
12) Other causes	4	-		0.166	-			
TOTAL	243	10	24,066,536	10.097	0.416			

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1960
Country: Belgium
Coal-field: Borinage

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	111	9	Including time for inward and outward journeys.	8.003	0.649			
2) Haulage and transport	70	1		5.047	0.072			
3) Movement of personnel	18	-		1.298	-			
4) Machinery, handling of tools and supports	75	-		5.407	-			
5) Falling objects	7	1		0.505	0.072			
6) Explosives and fumes	-	-		-	-			
7) Explosions of firedamp or coal dust	-	1		-	0.072			
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-			
9) Underground combustion and fires	-	-		-	-			
10) Inrushes of water	-	-		-	-			
11) Electricity	-	-		-	-			
12) Other causes	7	-		0.505	-			
TOTAL	288	12	13,869,696	20.765	0.865			

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1960
Country: Belgium
Coal-field: Centre

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	78	7	Including time for inward and outward journeys.	6.249	0.561			
2) Haulage and transport	39	-		3.125	-			
3) Movement of personnel	27	-		2.163	-			
4) Machinery, handling of tools and supports	55	1		4.406	0.080			
5) Falling objects	14	-		1.122	-			
6) Explosives and fumes	2	-		0.160	-			
7) Explosions of firedamp or coal dust	-	-		-	-			
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-			
9) Underground combustion and fires	-	-		-	-			
10) Inrushes of water	-	-		-	-			
11) Electricity	-	-		-	-			
12) Other causes	8	-		0.641	-			
TOTAL	223	8	12,481,480	17.866	0.641			

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1960
Country: Belgium
Coal-field: South

CAUSE	Number of casualties: Disablements as under (a) below	Number of casualties: Fatalities as under (b) below	Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place)	Group accidents as under (c) below: Number of accidents	Group accidents as under (c) below: Number of disablements as under (a)	Group accidents as under (c) below: Number of fatalities as under (b)
1) Falls of ground	446	29	Including time for inward and outward journeys.	5.541	0.361			
2) Haulage and transport	282	11		3.504	0.138			
3) Movement of personnel	108	1		1.342	0.012			
4) Machinery, handling of tools and supports	248	1		3.081	0.012			
5) Falling objects	36	1		0.447	0.012			
6) Explosives and fumes	3	-		0.037	-			
7) Explosions of firedamp or coal dust	-	1		-	0.012			
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-			
9) Underground combustion and fires	-	-		-	-			
10) Inrushes of water	-	-		-	-			
11) Electricity	1	-		0.012	-			
12) Other causes	30	1		0.373	0.012			
TOTAL	1,154	45	80,487,832	14.337	0.559			

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1960
Country: Belgium

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Coal-field: Campine

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	103	9	Including time for inward and outward journeys.	2.216	0.194			
2) Haulage and transport	62	9		1.334	0.194			
3) Movement of personnel	20	-		0.430	-			
4) Machinery, handling of tools and supports	55	1		1.183	0.021			
5) Falling objects	9	-		0.194	-			
6) Explosives and fumes	1	-		0.021	-			
7) Explosions of firedamp or coal dust	-	1		-	0.021			
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-			
9) Underground combustion and fires	-	-		-	-			
10) Inrushes of water	-	-		-	-			
11) Electricity	1	3		0.021	0.065			
12) Other causes	3	-		0.065	-			
TOTAL	254	23	46,489,408	5.464	0.495			

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS

AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1960
Country: Belgium
Coal-field: (Total for the Kingdom)

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	549	38	Including time for inward and outward journeys.	4.324	0.299			
2) Haulage and transport	344	20		2.709	0.157			
3) Movement of personnel	128	1		1.008	0.008			
4) Machinery, handling of tools and supports	303	2		2.386	0.016			
5) Falling objects	45	1		0.354	0.008			
6) Explosives and fumes	4	-		0.032	-			
7) Explosions of firedamp or coal dust	-	2		-	0.016			
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-			
9) Underground combustion and fires	-	-		-	-			
10) Inrushes of water	-	-		-	-			
11) Electricity	2	3		0.016	0.024			
12) Other causes	33	1		0.260	0.008			
TOTAL	1,408	68	126,977,240	11.089	0.536			

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1960
Country: France
Coal-field: Nord/Pas-de-Calais

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	744	28		4.833	0.182			
2) Haulage and transport	270	16		1.754	0.104			
3) Movement of personnel	368	4		2.391	0.026			
4) Machinery, handling of tools and supports	215	3		1.397	0.019			
5) Falling objects	221	1		1.436	0.007			
6) Explosives and fumes	5	-		0.032	-			
7) Explosions of firedamp or coal dust	-	-		-	-			
8) Sudden outbursts of firedamp, suffocation by natural gases	-	3		-	0.019			
9) Underground combustion and fires	-	-		-	-			
10) Inrushes of water	-	-		-	-			
11) Electricity	-	2		-	0.013			
12) Other causes	137	-		0.890	0.013			
TOTAL	1,960	57	153,926,191	12.733	0.370			

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS

AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1960
Country: France
Coal-field: Centre-Midi (not including Provence)

CAUSE	Number of casualties: Disablements as under (a) below	Number of casualties: Fatalities as under (b) below	Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below: Number of accidents	Group accidents: Number of disablements as under (a)	Group accidents: Number of fatalities as under (b)
1) Falls of ground	230	12		4.179	0.219			
2) Haulage and transport	141	2		2.562	0.036			
3) Movement of personnel	248	1		4.506	0.018			
4) Machinery, handling of tools and supports	137	-		2.489	-			
5) Falling objects	131	-		2.380	-			
6) Explosives and fumes	1	-		0.018	-			
7) Explosions of firedamp or coal dust	-	-		-	-			
8) Sudden outbursts of firedamp, suffocation by natural gases	-	2		-	0.036			
9) Underground combustion and fires	-	-		-	-			
10) Inrushes of water	-	-		-	-			
11) Electricity	1	1		0.018	0.018			
12) Other causes	37	-		0.672	-			
TOTAL	926	18	55,040,434	16.824	0.327			

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1960
Country: France

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Coal-field: Lorraine

CAUSE	Number of casualties: Disablements as under (a) below	Number of casualties: Fatalities as under (b) below	Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below: Number of accidents	Group accidents as under (c) below: Number of disablements as under (a)	Group accidents as under (c) below: Number of fatalities as under (b)
1) Falls of ground	254	8		5.262	0.166			
2) Haulage and transport	83	3		1.719	0.062			
3) Movement of personnel	123	2		2.548	0.041			
4) Machinery, handling of tools and supports	65	1		1.347	0.021			
5) Falling objects	135	-		2.797	-			
6) Explosives and fumes	2	-		0.041	-			
7) Explosions of firedamp or coal dust	-	-		-	-			
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-			
9) Underground combustion and fires	-	-		-	-			
10) Inrushes of water	-	-		-	-			
11) Electricity	-	-		-	-			
12) Other causes	30	2		0.621	0.041			
TOTAL	692	16	48,269,743	14.335	0.331			

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1960
Country: France
Coal-field: (not including Provence)

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	1,228	48		4.774	0.186			
2) Haulage and transport	494	21		1.920	0.082			
3) Movement of personnel	739	7		2.873	0.027			
4) Machinery, handling of tools and supports	417	4		1.621	0.016			
5) Falling objects	487	1		1.893	0.004			
6) Explosives and fumes	8	-		0.031	-			
7) Explosions of firedamp or coal dust	-	-		-	-			
8) Sudden outbursts of firedamp, suffocation by natural gases	-	5		-	0.019			
9) Underground combustion and fires	-	-		-	-			
10) Inrushes of water	-	-		-	-			
11) Electricity	1	3		0.004	0.012			
12) Other causes	204	2		0.793	0.008			
TOTAL	3,578	91	257,236,371	13.909	0.354			

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1960
Country: Italy

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Coal-field: Sulcis

CAUSE	Number of casualties: Disablements as under (a) below	Number of casualties: Fatalities as under (b) below	Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below: Number of accidents	Group accidents as under (c) below: Number of disablements as under (a)	Group accidents as under (c) below: Number of fatalities as under (b)
1) Falls of ground	9	1		1.808	0.201			
2) Haulage and transport	6	-		1.205	-			
3) Movement of personnel	5	-		1.005	-			
4) Machinery, handling of tools and supports	3	-		0.603	-			
5) Falling objects	9	-		1.808	-			
6) Explosives and fumes	-	-		-	-			
7) Explosions of firedamp or coal dust	-	-		-	-			
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-			
9) Underground combustion and fires	-	-		-	-			
10) Inrushes of water	-	-		-	-			
11) Electricity	-	-		-	-			
12) Other causes	3	-		0.603	-			
TOTAL	35	1	4,977,450	7.032	0.201			

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1960
Country: Netherlands

Coal-field: Limbourg

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	77	2		1.305	0.034			
2) Haulage and transport	112	4		1.898	0.067			
3) Movement of personnel	11	-		0.187	-			
4) Machinery, handling of tools and supports	46	-		0.780	-			
5) Falling objects	29	-		0.492	-			
6) Explosives and fumes	-	-		-	-			
7) Explosions of firedamp or coal dust	10	-		-	-			
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-			
9) Underground combustion and fires	-	-		-	-			
10) Inrushes of water	-	-		-	-			
11) Electricity	-	-		-	-			
12) Other causes	23	1		0.390	0.017			
TOTAL	298	7	58,994,136	5.052	0.118			

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

B. COMMON STATISTICAL SURVEY OF UNDERGROUND ACCIDENTS IN 1961

Year: 1961
Country: North-Rhine/Westphalia
Coal-field: Ruhr

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	2,085	103	-	4.702	0.232	-	-	-
2) Haulage and transport	1,073	89	-	2.420	0.201	-	-	-
3) Movement of personnel	1,122	44	-	2.530	0.099	-	-	-
4) Machinery, handling of tools and supports	398	11	-	0.898	0.025	-	-	-
5) Falling objects	1,224	24	-	2.760	0.054	-	-	-
6) Explosives and fumes	3	-	-	0.007	-	-	-	-
7) Explosions of firedamp or coal dust	1	-	-	0.002	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	2	-	-	0.005	-	-	-
9) Underground combustion and fires	1	1	-	0.002	0.002	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-
11) Electricity	6	3	-	0.014	0.007	-	-	-
12) Other causes	252	27	-	0.568	0.061	-	-	-
TOTAL	6,165	304	443,414,925	13.903	0.686	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1961
Country: North-Rhine/Westphalia
Coal-field: Aachen

CAUSE	Number of casualties: Disablements as under (a) below	Number of casualties: Fatalities as under (b) below	Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below: Number of accidents	Group accidents as under (c) below: Number of disablements as under (a)	Group accidents as under (c) below: Number of fatalities as under (b)
1) Falls of ground	154	8	-	3.892	0.202	-	-	-
2) Haulage and transport	97	7	-	2.452	0.177	-	-	-
3) Movement of personnel	65	1	1	1.643	0.025	-	-	-
4) Machinery, handling of tools and supports	16	2	-	0.404	0.051	-	-	-
5) Falling objects	96	2	-	2.426	0.051	-	-	-
6) Explosives and fumes	-	-	-	-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-
11) Electricity	1	-	-	0.025	-	-	-	-
12) Other causes	1	-	-	0.025	-	-	-	-
TOTAL	430	20	39,564,404	10.868	0.506	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS

AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1961
Country: North-Rhine/Westphalia
Coal-field: Ibbenbüren

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	26	-	-	2.745	-	-	-	-
2) Haulage and transport	16	1	1	1.689	0.106	-	-	-
3) Movement of personnel	24	-	-	2.534	-	-	-	-
4) Machinery, handling of tools and supports	5	2	-	0.528	0.211	-	-	-
5) Falling objects	11	1	-	1.161	0.106	-	-	-
6) Explosives and fumes	2	-	-	0.211	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-
11) Electricity	-	-	-	-	-	-	-	-
12) Other causes	16	-	-	1.689	-	-	-	-
TOTAL	100	4	9,472,595	10.557	0.423	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS

AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1961
Country: North-Rhine/
Coal-field: Westphalia

CAUSE	Number of casualties: Disablements as under (a) below	Number of casualties: Fatalities as under (b) below	Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below: Number of accidents	Group accidents as under (c) below: Number of disablements as under (a)	Group accidents as under (c) below: Number of fatalities as under (b)
1) Falls of ground	2,265	111	-	4.599	0.225	-	-	-
2) Haulage and transport	1,186	97	-	2.408	0.197	-	-	-
3) Movement of personnel	1,211	45	-	2.459	0.091	-	-	-
4) Machinery, handling of tools and supports	419	15	-	0.851	0.030	-	-	-
5) Falling objects	1,331	27	-	2.702	0.055	-	-	-
6) Explosives and fumes	5	-	-	0.010	-	-	-	-
7) Explosions of firedamp or coal dust	1	-	-	0.002	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	2	-	-	0.004	-	-	-
9) Underground combustion and fires	1	1	-	0.002	0.002	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-
11) Electricity	7	3	-	0.014	0.006	-	-	-
12) Other causes	269	27	-	0.546	0.055	-	-	-
TOTAL	6,695	328	492,511,924	13.593	0.665	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1961
Country: Saar

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Coal-field:

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	395	9	-	6.374	0.145	-	-	-
2) Haulage and transport	177	12	-	2.856	0.194	-	-	-
3) Movement of personnel	182	3	-	2.937	0.048	-	-	-
4) Machinery, handling of tools and supports	62	-	-	1.001	-	-	-	-
5) Falling objects	302	9	-	4.874	0.145	-	-	-
6) Explosives and fumes	-	-	-	-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-
11) Electricity	1	-	-	0.016	-	-	-	-
12) Other causes	10	-	-	0.161	-	-	-	-
TOTAL	1,129	33	61,966,241	18.220	0.533	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1961
Country: Germany
Coal-field: North-Rhine/Westphalia and Saar

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	2,660	120	-	4.797	0.216	-	-	-
2) Haulage and transport	1,363	109	-	2.458	0.196	-	-	-
3) Movement of personnel	1,393	48	-	2.512	0.086	-	-	-
4) Machinery, handling of tools and supports	481	15	-	0.867	0.027	-	-	-
5) Falling objects	1,633	36	-	2.945	0.065	-	-	-
6) Explosives and fumes	5	-	-	0.009	-	-	-	-
7) Explosions of firedamp or coal dust	1	-	-	0.002	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	2	-	-	0.004	-	-	-
9) Underground combustion and fires	1	1	-	0.002	0.002	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-
11) Electricity	8	3	-	0.014	0.005	-	-	-
12) Other causes	279	27	-	0.503	0.049	-	-	-
TOTAL	7,824	361	554,478,165	14.109	0.651	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS

AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1961
Country: Belgium

Coal-field: Charleroi-Namur

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	134	16	-	4.955	0.592	-	-	-
2) Haulage and transport	91	6	-	3.365	0.222	-	-	-
3) Movement of personnel	36	1	-	1.331	0.037	-	-	-
4) Machinery, handling of tools and supports	71	-	-	2.626	-	-	-	-
5) Falling objects	7	-	-	0.259	-	-	-	-
6) Explosives and fumes	1	-	-	0.037	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-
11) Electricity	1	-	-	0.037	-	-	-	-
12) Other causes	10	1	-	0.370	0.037	-	-	-
TOTAL	351	24	27,040,400	12.980	0.888	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS

AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1961
Country: Belgium

Coal-field: Liège

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	66	2	-	3.426	0.104	-	-	-
2) Haulage and transport	52	2	-	2.699	0.104	-	-	-
3) Movement of personnel	19	1	-	0.986	0.052	-	-	-
4) Machinery, handling of tools and supports	24	1	-	1.246	0.052	-	-	-
5) Falling objects	4	-	-	0.208	-	-	-	-
6) Explosives and fumes	-	-	-	-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	-	5	-	-	0.259	-	-	-
11) Electricity	-	-	-	-	-	-	-	-
12) Other causes	5	-	-	0.260	-	-	-	-
TOTAL	170	11	19,260,712	8.825	0.571	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1961
Country: Belgium
Coal-field: Borinage/Centre

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	170	3	-	7.747	0.137	-	-	-
2) Haulage and transport	114	4	-	5.195	0.182	-	-	-
3) Movement of personnel	43	2	-	1.959	0.091	-	-	-
4) Machinery, handling of tools and supports	82	1	-	3.737	0.046	-	-	-
5) Falling objects	7	-	-	0.319	-	-	-	-
6) Explosives and fumes	-	-	-	-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-
11) Electricity	-	-	-	-	-	-	-	-
12) Other causes	10	-	-	0.456	-	-	-	-
TOTAL	426	10	21,943,560	19.413	0.456	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1961
Country: Belgium

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Coal-field: South

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	370	21	-	5.420	0.307	-	-	-
2) Haulage and transport	257	12	-	3.765	0.176	-	-	-
3) Movement of personnel	98	4	-	1.436	0.059	-	-	-
4) Machinery, handling of tools and supports	177	2	-	2.593	0.029	-	-	-
5) Falling objects	18	-	-	0.264	-	-	-	-
6) Explosives and fumes	1	-	-	0.015	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	-	5	-	-	0.073	-	-	-
11) Electricity	1	-	-	0.015	-	-	-	-
12) Other causes	25	1	-	0.366	0.015	-	-	-
TOTAL	947	45	68,244,672	13.874	0.659	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1961
Country: Belgium

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Coal-field: Campine

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	90	9	-	2.015	0.202	-	-	-
2) Haulage and transport	56	7	-	1.254	0.157	-	-	-
3) Movement of personnel	22	-	-	0.493	-	-	-	-
4) Machinery, handling of tools and supports	60	1	-	1.343	0.022	-	-	-
5) Falling objects	16	-	-	0.358	-	-	-	-
6) Explosives and fumes	1	-	-	0.022	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-
11) Electricity	1	-	-	0.022	-	-	-	-
12) Other causes	9	-	-	0.202	-	-	-	-
TOTAL	255	17	44,656,712	5.709	0.381	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS

AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1961

Country: Belgium (Total for the Kingdom)

Coal-field:

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	460	30	-	4.071	0.266	-	-	-
2) Haulage and transport	313	19	-	2.770	0.168	-	-	-
3) Movement of personnel	120	4	-	1.062	0.035	-	-	-
4) Machinery, handling of tools and supports	237	3	-	2.097	0.027	-	-	-
5) Falling objects	34	-	-	0.301	-	-	-	-
6) Explosives and fumes	2	-	-	0.018	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	-	5	-	-	0.044	-	-	-
11) Electricity	2	-	-	0.018	-	-	-	-
12) Other causes	34	1	-	0.301	0.009	-	-	-
TOTAL	1,202	62	112,901,384	10.638	0.549	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS

AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1961
Country: France

Coal-field: Nord/Pas-de-Calais

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	662	20	-	4.632	0.140	-	-	-
2) Haulage and transport	270	17	-	1.889	0.119	-	-	-
3) Movement of personnel	306	1	-	2.141	0.007	-	-	-
4) Machinery, handling of tools and supports	333	-	-	2.330	-	-	-	-
5) Falling objects	285	1	-	1.994	0.007	-	-	-
6) Explosives and fumes	1	-	-	0.007	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-
11) Electricity	3	-	-	0.021	-	-	-	-
12) Other causes	40	-	-	0.279	-	-	-	-
TOTAL	1,900	39	142,920,824	13.293	0.273	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1961
Country: France
Coal-field: Centre-Midi (not including Provence)

C A U S E	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	209	14	-	4.233	0.283	-	-	-
2) Haulage and transport	150	6	-	3.038	0.122	-	-	-
3) Movement of personnel	137	-	-	2.775	-	-	-	-
4) Machinery, handling of tools and supports	208	-	-	4.212	-	-	-	-
5) Falling objects	119	1	-	2.410	0.020	-	-	-
6) Explosives and fumes	2	-	-	0.040	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-
11) Electricity	3	-	-	0.061	-	-	-	-
12) Other causes	35	-	-	0.709	-	-	-	-
TOTAL	863	21	49,376,693	17.478	0.425	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS

AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1961
Country: France

Coal-field: Lorraine

CAUSE	Number of casualties: Disablements as under (a) below	Number of casualties: Fatalities as under (b) below	Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below: Number of accidents	Group accidents as under (c) below: Number of disablements as under (a)	Group accidents as under (c) below: Number of fatalities as under (b)
1) Falls of ground	177	18	-	3.927	0.399	1	-	7
2) Haulage and transport	80	6	-	1.775	0.133	-	-	-
3) Movement of personnel	111	1	-	2.462	0.022	-	-	-
4) Machinery, handling of tools and supports	58	2	-	1.287	0.045	-	-	-
5) Falling objects	140	2	-	3.106	0.045	-	-	-
6) Explosives and fumes	1	-	-	0.022	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	1	-	-	0.022	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	-	1	-	-	0.022	-	-	-
11) Electricity	1	-	-	0.022	-	-	-	-
12) Other causes	11	-	-	0.244	-	-	-	-
TOTAL	579	31	45,076,248	12.845	0.688	1	-	7

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1961
Country: France (total)
Coal-field: not including Provence

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS

AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	1,048	52	-	4.416	0.219	1	-	7
2) Haulage and transport	500	29	-	2.106	0.122	-	-	-
3) Movement of personnel	554	2	-	2.334	0.008	-	-	-
4) Machinery, handling of tools and supports	599	2	-	2.523	0.008	-	-	-
5) Falling objects	544	4	-	2.292	0.017	-	-	-
6) Explosives and fumes	4	-	-	0.017	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	1	-	-	0.004	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	-	1	-	-	0.004	-	-	-
11) Electricity	7	-	-	0.029	-	-	-	-
12) Other causes	86	-	-	0.362	-	-	-	-
TOTAL	3,342	91	237,373,765	14.079	0.382	1	-	7

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1961
Country: Italy
Coal-field: Sulcis

CAUSE	Number of casualties: Disablements as under (a) below	Number of casualties: Fatalities as under (b) below	Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below: Number of accidents	Group accidents: Number of disablements as under (a)	Group accidents: Number of fatalities as under (b)
1) Falls of ground	-	1	-	-	0.225	-	-	-
2) Haulage and transport	3	-	-	0.676	-	-	-	-
3) Movement of personnel	7	-	-	1.578	-	-	-	-
4) Machinery, handling of tools and supports	4	-	-	0.902	-	-	-	-
5) Falling objects	9	-	-	2.029	-	-	-	-
6) Explosives and fumes	1	-	-	0.225	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-
11) Electricity	-	-	-	-	-	-	-	-
12) Other causes	2	-	-	0.451	-	-	-	-
TOTAL	26	1	4,434,781	5.861	0.225	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1961
Country: Netherlands
Coal-field: Limbourg

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS AT MINES IN THE E.C.S.C. COUNTRIES

C A U S E	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	96	6	-	1.829	0.114	-	-	-
2) Haulage and transport	101	5	-	1.924	0.095	-	-	-
3) Movement of personnel	27	-	-	0.514	-	-	-	-
4) Machinery, handling of tools and supports	48	-	-	0.915	-	-	-	-
5) Falling objects	43	-	-	0.819	-	-	-	-
6) Explosives and fumes	-	-	-	-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-
11) Electricity	-	1	-	-	0.019	-	-	-
12) Other causes	11	-	-	0.210	-	-	-	-
TOTAL	326	12	52,482,544	6.212	0.229	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

C. COMMON STATISTICAL SURVEY OF UNDERGROUND ACCIDENTS IN 1962

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1962
Country: North-Rhine/Westphalia
Coal-field: Ruhr

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	1,836	124	-	4.474	0.302	1	1	6
2) Haulage and transport	982	61	-	2.393	0.149	-	-	-
3) Movement of personnel	1,081	26	-	2.634	0.063	-	-	-
4) Machinery, handling of tools and supports	435	16	-	1.060	0.039	-	-	-
5) Falling objects	1,114	42	-	2.715	0.102	-	-	-
6) Explosives and fumes	3	2	-	0.007	0.005	-	-	-
7) Explosions of firedamp or coal dust	2	30	-	0.005	0.073	1	1	31
8) Sudden outbursts of firedamp, suffocation by natural gases	-	1	-	-	0.003	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-
11) Electricity	2	4	-	0.005	0.010	-	-	-
12) Other causes	236	23	-	0.575	0.056	-	-	-
TOTAL	5,691	329	410,383,434	13.868	0.802	2	2	37

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS

AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1962
Country: North-Rhine/Westphalia
Coal-field: Aachen

CAUSE	Number of casualties: Disablements as under (a) below	Number of casualties: Fatalities as under (b) below	Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below: Number of accidents	Group accidents as under (c) below: Number of disablements as under (a)	Group accidents as under (c) below: Number of fatalities as under (b)
1) Falls of ground	138	9	-	3.753	0.245	-	-	-
2) Haulage and transport	81	4	-	2.203	0.109	-	-	-
3) Movement of personnel	58	1	-	1.577	0.027	-	-	-
4) Machinery, handling of tools and supports	9	2	-	0.245	0.054	-	-	-
5) Falling objects	112	3	-	3.046	0.082	-	-	-
6) Explosives and fumes	-	-	-	-	-	-	-	-
7) Explosions of firedamp or coal dust	2	8	-	0.054	0.218	1	2	8
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-
11) Electricity	-	-	-	-	-	-	-	-
12) Other causes	-	-	-	-	-	-	-	-
TOTAL	400	27	36,771,595	10.878	0.734	1	2	8

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1962
Country: North-Rhine/Westphalia
Coal-field: Ibbenbüren

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	27	2	-	2.908	0.215	-	-	-
2) Haulage and transport	19	1	-	2.046	0.108	-	-	-
3) Movement of personnel	8	-	-	0.861	-	-	-	-
4) Machinery, handling of tools and supports	3	-	-	0.323	-	-	-	-
5) Falling objects	8	-	-	0.862	-	-	-	-
6) Explosives and fumes	-	-	-	-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-
11) Electricity	-	-	-	-	-	-	-	-
12) Other causes	11	1	-	1.185	0.108	-	-	-
TOTAL	76	4	9,284,752	8.185	0.431	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1962
Country: North-Rhine/Westphalia
Coal-field:

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	2,001	135	-	4.384	0.296	1	1	6
2) Haulage and transport	1,082	66	-	2.370	0.144	-	-	-
3) Movement of personnel	1,147	27	-	2.513	0.059	-	-	-
4) Machinery, handling of tools and supports	447	18	-	0,979	0.039	-	-	-
5) Falling objects	1,234	45	-	2.703	0.098	-	-	-
6) Explosives and fumes	3	2	-	0.006	0.004	-	-	-
7) Explosions of firedamp or coal dust	4	38	-	0.009	0.083	2	3	39
8) Sudden outbursts of firedamp, suffocation by natural gases	-	1	-	-	0.002	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-
11) Electricity	2	4	-	0.004	0.009	-	-	-
12) Other causes	247	24	-	0.541	0.052	-	-	-
TOTAL	6,167	360	456,439,781	13.511	0.789	3	4	45

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1962
Country: Germany

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Coal-field: Saar

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	388	8		7.207	0.149	-	-	-
2) Haulage and transport	194	10		3.604	0.186	-	-	-
3) Movement of personnel	184	3		3.418	0.056	-	-	-
4) Machinery, handling of tools and supports	87	1		1.616	0.019	-	-	-
5) Falling objects	336	3		6.241	0.056	-	-	-
6) Explosives and fumes	1	-		0.019	-	-	-	-
7) Explosions of firedamp or coal dust	59	299		1.096	5.554	1	59	299
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	1	1		0.019	0.019	-	-	-
12) Other causes	2	1		0.037	0.019	-	-	-
TOTAL	1,252	326	53,833,701	23.257	6.056	1	59	299

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS

AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1962
Country: Germany
Coal-field: North-Rhine/Westphalia and Saar

CAUSE	Number of casualties: Disablements as under (a) below	Number of casualties: Fatalities as under (b) below	Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below: Number of accidents	Group accidents as under (c) below: Number of disablements as under (a)	Group accidents as under (c) below: Number of fatalities as under (b)
1) Falls of ground	2,389	143		4.682	0.280	1	1	6
2) Haulage and transport	1,276	76		2.501	0.149	-	-	-
3) Movement of personnel	1,331	30		2.608	0.059	-	-	-
4) Machinery, handling of tools and supports	534	19		1.046	0.037	-	-	-
5) Falling objects	1,570	48		3.077	0.094	-	-	-
6) Explosives and fumes	4	2		0.008	0.004	-	-	-
7) Explosions of firedamp or coal dust	63	337		0.123	0.660	3	62	338
8) Sudden outbursts of firedamp, suffocation by natural gases	-	1		-	0.002	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	3	5		0.006	0.010	-	-	-
12) Other causes	249	25		0.488	0.049	-	-	-
TOTAL	7,419	686	510,273,482	14.539	1.344	4	63	344

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1962
Country: Belgium
Coal-field: Charleroi-Namur

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties: Disablements as under (a) below	Number of casualties: Fatalities as under (b) below	Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below: Number of accidents	Group accidents as under (c) below: Number of disablements as under (a)	Group accidents as under (c) below: Number of fatalities as under (b)
1) Falls of ground	122	14	Including time for inward and outward journeys.	4.594	0.527	1	2	6
2) Haulage and transport	77	1		2.900	0.038	-	-	-
3) Movement of personnel	33	-		1.243	-	-	-	-
4) Machinery, handling of tools and supports	71	1		2.674	0.038	-	-	-
5) Falling objects	10	-		0.376	-	-	-	-
6) Explosives and fumes	-	-		-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	1		-	0.038	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	-	-		-	-	-	-	-
12) Other causes	16	1		0.602	0.037	-	-	-
TOTAL	329	18	26,555,736	12.389	0.678	1	2	6

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS

AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1962
Country: Belgium

Coal-field: Liège

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	92	9	Including time for inward and outward journeys.	4.847	0.474	-	-	-
2) Haulage and transport	69	8		3.636	0.422	-	-	-
3) Movement of personnel	26	-		1.370	-	-	-	-
4) Machinery, handling of tools and supports	21	-		1.106	-	-	-	-
5) Falling objects	4	1		0.211	0.053	-	-	-
6) Explosives and fumes	-	-		-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	5		-	0.263	-	-	-
11) Electricity	-	-		-	-	-	-	-
12) Other causes	4	-		0.211	-	-	-	-
TOTAL	216	23	18,978,208	11.381	1.212	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1962
Country: Belgium
Coal-field: Borinage-Centre

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	134	2	Including time for inward and outward journeys.	8.209	0.123	-	-	-
2) Haulage and transport	105	1		6.432	0.061	-	-	-
3) Movement of personnel	37	-		2.267	-	-	-	-
4) Machinery, handling of tools and supports	88	-		5.391	-	-	-	-
5) Falling objects	17	-		1.041	-	-	-	-
6) Explosives and fumes	-	-		-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	4		-	0.245	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	1	-		0.061	-	-	-	-
11) Electricity	1	-		0.061	-	-	-	-
12) Other causes	9	1		0.551	0.061	-	-	-
TOTAL	392	8	16,324,400	24.013	0.490	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1962
Country: Belgium
Coal-field: South

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	348	25	Including time for inward and outward journeys.	5.626	0.404	1	2	6
2) Haulage and transport	251	10		4.058	0.162	-	-	-
3) Movement of personnel	96	-		1.552	-	-	-	-
4) Machinery, handling of tools and supports	180	1		2.910	0.016	-	-	-
5) Falling objects	31	1		0.501	0.016	-	-	-
6) Explosives and fumes	-	-		-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	5		-	0.081	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	1	5		0.016	0.081	-	-	-
11) Electricity	1	-		0.016	-	-	-	-
12) Other causes	29	2		0.469	0.032	-	-	-
TOTAL	937	49	61,858,344	15.148	0.792	1	2	6

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1962
Country: Belgium
Coal-field: Campine

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	121	1	Including time for inward and outward journeys.	2.762	0.023	-	-	-
2) Haulage and transport	101	5		2.306	0.114	-	-	-
3) Movement of personnel	24	1		0.548	0.023	-	-	-
4) Machinery, handling of tools and supports	80	4		1.827	0.091	-	-	-
5) Falling objects	16	-		0.365	-	-	-	-
6) Explosives and fumes	-	-		-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	-	-		-	-	-	-	-
12) Other causes	6	-		0.137	-	-	-	-
TOTAL	348	11	43,803,760	7.945	0.251	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1962
Country: Belgium
Coal-field: (Total for the Kingdom)

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	469	26	Including time for inward and outward journeys.	4.439	0.246	1	2	6
2) Haulage and transport	352	15		3.331	0.142	-	-	-
3) Movement of personnel	120	1		1.136	0.010	-	-	-
4) Machinery, handling of tools and supports	260	5		2.461	0.047	-	-	-
5) Falling objects	47	1		0.445	0.010	-	-	-
6) Explosives and fumes	-	-		-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	5		-	0.047	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	1	5		0.010	0.047	-	-	-
11) Electricity	1	-		0.010	-	-	-	-
12) Other causes	35	2		0.331	0.019	-	-	-
TOTAL	1,285	60	105,662,104	12.161	0.568	1	2	6

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS

AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1962
Country: France
Coal-field: Nord/Pas-de-Calais

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	657	24		4.629	0.170	1	-	6
2) Haulage and transport	309	10		2.177	0.070	-	-	
3) Movement of personnel	299	5		2.106	0.035	-	-	-
4) Machinery, handling of tools and supports	420	5		2.959	0.035	-	-	-
5) Falling objects	284	4		2.001	0.028	-	-	-
6) Explosives and fumes	4	-		0.028	-	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	1	2		0.007	0.014	-	-	-
12) Other causes	41	1		0.289	0.007	-	-	-
TOTAL	2,015	51	141,935,032	14.196	0.359	1	-	6

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1962
Country: France
Coal-field: Centre-Midi (not including Provence)

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	172	6		3.699	0.128	-	-	-
2) Haulage and transport	109	1		2.343	0.022	-	-	-
3) Movement of personnel	144	2		3.096	0.042	-	-	-
4) Machinery, handling of tools and supports	208	1		4.472	0.022	-	-	-
5) Falling objects	105	1		2.257	0.022	-	-	-
6) Explosives and fumes	6	-		0.129	-	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	-	-		-	-	-	-	-
12) Other causes	13	1		0.279	0.022	-	-	-
TOTAL	757	12	46,491,552	16.275	0.258	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1962
Country: France
Coal-field: Lorraine

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place)	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	155	9		3.469	0.202	-	-	-
2) Haulage and transport	94	7		2.105	0.157	-	-	-
3) Movement of personnel	130	3		2.911	0.067	-	-	-
4) Machinery, handling of tools and supports	69	1		1.545	0.022	-	-	-
5) Falling objects	94	2		2.105	0.045	-	-	-
6) Explosives and fumes	2	-		0.045	-	-	-	-
7) Explosions of firedamp or coal dust	1	1		0.022	0.022	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	-	-		-	-	-	-	-
12) Other causes	2	-		0.045	-	-	-	-
TOTAL	547	23	44,655,224	12.247	0.515	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS

AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1962
Country: France (not including Provence)
Coal-field:

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	984	39		4.222	0.167	1	-	6
2) Haulage and transport	512	18		2.196	0.077	-	-	-
3) Movement of personnel	573	10		2.458	0.043	-	-	-
4) Machinery, handling of tools and supports	687	7		2.991	0.030	-	-	-
5) Falling objects	483	7		2.073	0.030	-	-	-
6) Explosives and fumes	12	-		0.051	-	-	-	-
7) Explosions of firedamp or coal dust	1	1		0.004	0.004	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	1	2		0.004	0.009	-	-	-
12) Other causes	56	2		0.240	0.009	-	-	-
TOTAL	3,319	86	233,081,808	14.239	0.369	1	-	6

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1962
Country: Italy

Coal-field: Sulcis

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	3	-		0.792	-	-	-	-
2) Haulage and transport	7	-		1.847	-	-	-	-
3) Movement of personnel	4	-		1.056	-	-	-	-
4) Machinery, handling of tools and supports	6	-		1.584	-	-	-	-
5) Falling objects	9	-		2.375	-	-	-	-
6) Explosives and fumes	-	-		-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	-	-		-	-	-	-	-
12) Other causes	-	-		-	-	-	-	-
TOTAL	29	-	3,788,603	7.654	-	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1962
Country: Netherlands
Coal-field: Limbourg

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties: Disablements as under (a) below	Number of casualties: Fatalities as under (b) below	Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below: Number of accidents	Group accidents as under (c) below: Number of disablements as under (a)	Group accidents as under (c) below: Number of fatalities as under (b)
1) Falls of ground	108	3		2.238	0.062	-	-	-
2) Haulage and transport	125	3		2.590	0.062	-	-	-
3) Movement of personnel	28	-		0.580	-	-	-	-
4) Machinery, handling of tools and supports	49	2		1.015	0.041	-	-	-
5) Falling objects	31	-		0.642	-	-	-	-
6) Explosives and fumes	-	-		-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	1	-		0.021	-	-	-	-
12) Other causes	24	-		0.497	-	-	-	-
TOTAL	366	8	48,269,112	7.583	0.166	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

D. COMMON STATISTICAL SURVEY OF UNDERGROUND ACCIDENTS FOR 1963

Year: 1963
Country: North-Rhine/Westphalia
Coal-field: Ruhr

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties: Disablements as under (a) below	Number of casualties: Fatalities as under (b) below	Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below: Number of accidents	Group accidents as under (c) below: Number of disablements as under (a)	Group accidents as under (c) below: Number of fatalities as under (b)
1) Falls of ground	1,823	100	-	4.676	0.257	-	-	-
2) Haulage and transport	922	70	-	2.365	0.180	-	-	-
3) Movement of personnel	1,017	37	-	2.609	0.095	-	-	-
4) Machinery, handling of tools and supports	480	8	-	1.231	0.020	-	-	-
5) Falling objects	1,095	33	-	2.809	0.085	-	-	-
6) Explosives and fumes	1	-	-	0.002	-	-	-	-
7) Explosions of firedamp or coal dust	5	1	-	0.013	0.002	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	3	-	-	0.008	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-
11) Electricity	2	1	-	0.005	0.002	-	-	-
12) Other causes	212	12	-	0.544	0.031	-	-	-
TOTAL	5,557	265	389,843,667	14.254	0.680	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1963
Country: North-Rhine/Westphalia
Coal-field: Aachen

CAUSE	Number of casualties: Disablements as under (a) below	Number of casualties: Fatalities as under (b) below	Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below: Number of accidents	Group accidents: Number of disablements as under (a)	Group accidents: Number of fatalities as under (b)
1) Falls of ground	93	4	-	2.703	0.116	-	-	-
2) Haulage and transport	85	4	-	2.470	0.116	-	-	-
3) Movement of personnel	51	3	-	1.482	0.087	-	-	-
4) Machinery, handling of tools and supports	15	1	-	0.436	0.029	-	-	-
5) Falling objects	74	-	-	2.150	-	-	-	-
6) Explosives and fumes	-	-	-	-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-
11) Electricity	2	-	-	0.058	-	-	-	-
12) Other causes	2	-	-	0.058	-	-	-	-
TOTAL	322	12	34,410,642	9.358	0.349	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1963
Country: North-Rhine/Westphalia
Coal-field: Ibbenbüren

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	21	7	-	2.222	0.740	-	-	-
2) Haulage and transport	11	2	-	1.164	0.212	-	-	-
3) Movement of personnel	17	-	-	1.798	-	-	-	-
4) Machinery, handling of tools and supports	9	-	-	0.952	-	-	-	-
5) Falling objects	17	-	-	1.798	-	-	-	-
6) Explosives and fumes	-	-	-	-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-
11) Electricity	-	-	-	-	-	-	-	-
12) Other causes	13	-	-	1.376	-	-	-	-
TOTAL	88	9	9,452,280	9.310	0.952	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1963
Country: North-Rhine/Westphalia
Coal-field:

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	1,937	111	-	4.466	0.256	-	-	-
2) Haulage and transport	1,018	76	-	2.347	0.175	-	-	-
3) Movement of personnel	1,085	40	-	2.502	0.092	-	-	-
4) Machinery, handling of tools and supports	504	9	-	1.162	0.021	-	-	-
5) Falling objects	1,186	33	-	2.735	0.076	-	-	-
6) Explosives and fumes	1	-	-	0.002	-	-	-	-
7) Explosions of firedamp or coal dust	5	1	-	0.011	0.002	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	3	-	-	0.007	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-
11) Electricity	4	1	-	0.009	0.002	-	-	-
12) Other causes	227	12	-	0.523	0.028	-	-	-
TOTAL	5,967	286	433,706,589	13.758	0.659	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1963
Country: Germany
Coal-field: Saar

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	319	15	-	6.366	0.299	-	-	-
2) Haulage and transport	159	10	-	3.173	0.199	-	-	-
3) Movement of personnel	195	3	-	3.891	0.059	-	-	-
4) Machinery, handling of tools and supports	83	-	-	1.656	-	-	-	-
5) Falling objects	284	2	-	5.667	0.039	-	-	-
6) Explosives and fumes	2	-	-	0.039	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	2	2	-	0.039	0.039	-	-	-
11) Electricity	2	-	-	0.039	-	-	-	-
12) Other causes	2	-	-	0.039	-	-	-	-
TOTAL	1,048	32	50,108,834	20.914	0.638	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS

AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1963
Country: Germany
Coal-field: North-Rhine/Westphalia and Saarland

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	2,256	126	-	4.663	0.260	-	-	-
2) Haulage and transport	1,177	86	-	2.433	0.178	-	-	-
3) Movement of personnel	1,280	43	-	2.646	0.089	-	-	-
4) Machinery, handling of tools and supports	587	9	-	1.213	0.019	-	-	-
5) Falling objects	1,470	35	-	3.038	0.072	-	-	-
6) Explosives and fumes	3	-	-	0.006	-	-	-	-
7) Explosions of firedamp or coal dust	5	1	-	0.010	0.002	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	3	-	-	0.006	-	-	-
10) Inrushes of water	2	2	-	0.004	0.004	-	-	-
11) Electricity	6	1	-	0.012	0.002	-	-	-
12) Other causes	229	12	-	0.473	0.025	-	-	-
TOTAL	7,015	318	483,815,423	14.499	0.657	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1963
Country: Belgium

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS

AT MINES IN THE E.C.S.C. COUNTRIES

Coal-field: Charleroi-Namur

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	111	10	Including time for inward and outward journeys.	4.001	0.361	-	-	-
2) Haulage and transport	90	6		3.244	0.216	-	-	-
3) Movement of personnel	44	1		1.586	0.036	-	-	-
4) Machinery, handling of tools and supports	64	-		2.307	-	-	-	-
5) Falling objects	14	-		0.505	-	-	-	-
6) Explosives and fumes	1	-		0.036	-	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	2		-	0.072	-	-	-
11) Electricity	-	-		-	-	-	-	-
12) Other causes	11	1		0.397	0.036	-	-	-
TOTAL	335	20	27,740,720	12.076	0.721	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1963
Country: Belgium
Coal-field: Liège

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	87	7	Including time for inward and outward journeys.	4.593	0.370	-	-	-
2) Haulage and transport	78	7		4.118	0.370	-	-	-
3) Movement of personnel	15	3		0.792	0.158	-	-	-
4) Machinery, handling of tools and supports	39	-		2.059	-	-	-	-
5) Falling objects	12	-		0.633	-	-	-	-
6) Explosives and fumes	-	-		-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	-	-		-	-	-	-	-
12) Other causes	3	2		0.158	0.105	-	-	-
TOTAL	234	19	18,941,342	12.353	1.003	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1963
Country: Belgium
Coal-field: Borinage-Centre

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	116	6	Including time for inward and outward journeys.	7.650	0.396	-	-	-
2) Haulage and transport	95	2		6.265	0.132	-	-	-
3) Movement of personnel	21	1		1.385	0.066	-	-	-
4) Machinery, handling of tools and supports	57	-		3.759	-	-	-	-
5) Falling objects	11	-		0.726	-	-	-	-
6) Explosives and fumes	-	-		-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	-	-		-	-	-	-	-
12) Other causes	4	-		0.264	-	-	-	-
TOTAL	304	9	15,161,632	20.049	0.594	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1963
Country: Belgium

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Coal-field: South

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	314	23	Including time for inward and outward journeys.	5.074	0.372	-	-	-
2) Haulage and transport	263	15		4.250	0.242	-	-	-
3) Movement of personnel	80	5		1.293	0.081	-	-	-
4) Machinery, handling of tools and supports	160	-		2.586	-	-	-	-
5) Falling objects	37	-		0.598	-	-	-	-
6) Explosives and fumes	1	-		0.016	-	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	2		-	0.032	-	-	-
11) Electricity	-	-		-	-	-	-	-
12) Other causes	18	3		0.291	0.049	-	-	-
TOTAL	873	48	61,843,694	14.108	0.776	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1963
Country: Belgium

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS AT MINES IN THE E.C.S.C. COUNTRIES

Coal-field: Campine

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	156	5	Including time for inward and outward journeys.	3.529	0.113	-	-	-
2) Haulage and transport	115	11		2.601	0.249	-	-	-
3) Movement of personnel	33	1		0.746	0.023	-	-	-
4) Machinery, handling of tools and supports	96	-		2.171	-	-	-	-
5) Falling objects	21	2		0.475	0.045	-	-	-
6) Explosives and fumes	1	-		0.023	-	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	1	1		0.023	0.023	-	-	-
12) Other causes	3	-		0.068	-	-	-	-
TOTAL	426	20	44,199,316	9.636	0.453	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1963
Country: Belgium
Coal-field: (Total for the Kingdom)

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	470	28		4.432	0.264	-	-	-
2) Haulage and transport	378	26		3.565	0.245	-	-	-
3) Movement of personnel	113	6		1.066	0.057	-	-	-
4) Machinery, handling of tools and supports	256	-		2.414	-	-	-	-
5) Falling objects	58	2		0.547	0.019	-	-	-
6) Explosives and fumes	2	-		0.019	-	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	2		-	0.019	-	-	-
11) Electricity	1	1		0.009	0.009	-	-	-
12) Other causes	21	3		0.198	0.028	-	-	-
TOTAL	1,299	68	106,043,010	12.250	0.641	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1963
Country: France
Coal-field: Nord/Pas-de-Calais

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties: Disablements as under (a) below	Number of casualties: Fatalities as under (b) below	Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below: Number of accidents	Group accidents as under (c) below: Number of disablements as under (a)	Group accidents as under (c) below: Number of fatalities as under (b)
1) Falls of ground	565	16		4.441	0.126			
2) Haulage and transport	295	18		2.319	0.141			
3) Movement of personnel	264	1		2.075	0.008			
4) Machinery, handling of tools and supports	361	2		2.837	0.016			
5) Falling objects	278	-		2.185	-			
6) Explosives and fumes	2	1		0.016	0.008			
7) Explosions of firedamp or coal dust	-	-		-	-			
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-			
9) Underground combustion and fires	-	-		-	-			
10) Inrushes of water	-	-		-	-			
11) Electricity	2	2		0.016	0.016			
12) Other causes	50	2		0.393	0.016			
TOTAL	1,817	42	127,224,544	14.281	0.330			

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1963
Country: France
Coal-field: Centre-Midi (not including Provence)

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS

AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	158	5	-	3.787	0.120	-	-	-
2) Haulage and transport	114	2	-	2.733	0.048	-	-	-
3) Movement of personnel	115	-	-	2.757	-	-	-	-
4) Machinery, handling of tools and supports	230	-	-	5.513	-	-	-	-
5) Falling objects	108	2	-	2.589	0.048	-	-	-
6) Explosives and fumes	-	-	-	-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	3	-	-	0.019	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-
11) Electricity	1	2	-	0.024	0.048	-	-	-
12) Other causes	15	-	-	0.360	-	-	-	-
TOTAL	741	14	41,716,688	17.763	0.336	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1963
Country: France
Coal-field: Lorraine

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	150	4	-	3.745	0.100	-	-	-
2) Haulage and transport	85	5	-	2.122	0.125	-	-	-
3) Movement of personnel	116	1	-	2.896	0.025	-	-	-
4) Machinery, handling of tools and supports	56	-	-	1.398	-	-	-	-
5) Falling objects	90	-	-	2.247	-	-	-	-
6) Explosives and fumes	-	-	-	-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	1	-	-	0.025	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-
11) Electricity	-	1	-	-	0.025	-	-	-
12) Other causes	9	1	-	0.225	0.025	-	-	-
TOTAL	506	13	40,058,120	12.631	0.325	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1963
Country: France (not including Provence)
Coal-field:

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	873	25	-	4.177	0.120	-	-	-
2) Haulage and transport	494	25	-	2.364	0.121	-	-	-
3) Movement of personnel	495	2	-	2.368	0.009	-	-	-
4) Machinery, handling of tools and supports	647	2	-	3.096	0.009	-	-	-
5) Falling objects	476	2	-	2.278	0.009	-	-	-
6) Explosives and fumes	2	1	-	0.009	0.005	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	4	-	-	0.019	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-
11) Electricity	3	5	-	0.014	0.024	-	-	-
12) Other causes	74	3	-	0.354	0.014	-	-	-
TOTAL	3,064	69	208,999,352	14.660	0.330	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1963
Country: Italy
Coal-field: Sulcis

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	1	1	-	0.366	0.366	-	-	-
2) Haulage and transport	4	-	-	1.465	-	-	-	-
3) Movement of personnel	2	-	-	0.732	-	-	-	-
4) Machinery, handling of tools and supports	4	-	-	1.465	-	-	-	-
5) Falling objects	9	-	-	3.296	-	-	-	-
6) Explosives and fumes	1	-	-	0.366	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-
11) Electricity	-	-	-	-	-	-	-	-
12) Other causes	-	-	-	-	-	-	-	-
TOTAL	21	1	2,730,847	7.690	0.366	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS

AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1963
Country: Netherlands

Coal-field: Limbourg

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	83	4	-	1.742	0.084	-	-	-
2) Haulage and transport	87	5	-	1.826	0.105	-	-	-
3) Movement of personnel	30	-	-	0.630	-	-	-	-
4) Machinery, handling of tools and supports	50	-	-	1.050	-	-	-	-
5) Falling objects	30	-	-	0.630	-	-	-	-
6) Explosives and fumes	-	-	-	-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-
11) Electricity	-	-	-	-	-	-	-	-
12) Other causes	7	-	-	0.147	-	-	-	-
TOTAL	287	9	47,633,952	6.025	0.189	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

E. COMMON STATISTICAL SURVEY OF UNDERGROUND ACCIDENTS IN 1964

Year: 1964
Country: North-Rhine/Westphalia
Coal-field: Ruhr

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	1,854	78		4.839	0.204	-	-	-
2) Haulage and transport	881	80		2.300	0.209	2	5	14
3) Movement of personnel	1,024	29		2.673	0.076	-	-	-
4) Machinery, handling of tools and supports	487	12		1.271	0.031	-	-	-
5) Falling objects	1,142	19		2.981	0.049	-	-	-
6) Explosives and fumes	3	1		0.008	0.003	-	-	-
7) Explosions of firedamp or coal dust	-	1		-	0.003	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	4		-	0.010	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	2	2		0.005	0.005	-	-	-
12) Other causes	216	7		0.564	0.018	-	-	-
TOTAL	5,609	233	383,107,691	14.641	0.608	2	5	14

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1964
Country: North-Rhine/Westphalia
Coal-field: Aachen

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	88	6		2.674	0.182	-	-	-
2) Haulage and transport	62	10		1.884	0.304	-	-	-
3) Movement of personnel	36	2		1.094	0.061	-	-	-
4) Machinery, handling of tools and supports	20	1		0.608	0.030	-	-	-
5) Falling objects	86	3		2.613	0.091	-	-	-
6) Explosives and fumes	-	-		-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	-	-		-	-	-	-	-
12) Other causes	-	-		-	-	-	-	-
TOTAL	292	22	32,909,759	8.873	0.668	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1964
Country: North-Rhine/Westphalia
Coal-field:

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	1,942	84		4.667	0.202	-	-	-
2) Haulage and transport	943	90		2.266	0.216	2	5	14
3) Movement of personnel	1,060	31		2.547	0.074	-	-	-
4) Machinery, handling of tools and supports	507	13		1.218	0.031	-	-	-
5) Falling objects	1,228	22		2.951	0.053	-	-	-
6) Explosives and fumes	3	1		0.007	0.002	-	-	-
7) Explosions of firedamp or coal dust	-	1		-	0.002	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	4		-	0.010	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	2	2		0.005	0.005	-	-	-
12) Other causes	216	7		0.519	0.017	-	-	-
TOTAL	5,901	255	416,117,450	14.181	0.613	2	5	14

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1964
Country: Saar
Coal-field:

CAUSE	Number of casualties: Disablements as under (a) below	Number of casualties: Fatalities as under (b) below	Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below: Number of accidents	Group accidents: Number of disablements as under (a)	Group accidents: Number of fatalities as under (b)
1) Falls of ground	327	9		6.884	0.189	-	-	-
2) Haulage and transport	163	3		3.431	0.063	-	-	-
3) Movement of personnel	212	2		4.463	0.042	-	-	-
4) Machinery, handling of tools and supports	69	-		1.453	-	-	-	-
5) Falling objects	275	3		5.789	0.063	-	-	-
6) Explosives and fumes	-	-		-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	2	-		0.042	-	-	-	-
12) Other causes	5	1		0.105	0.021	-	-	-
TOTAL	1,053	18	47,501,106	22.167	0.378	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1964
Country: Germany
Coal-field: North-Rhine/Westphalia and Saar

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS

AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	2,269	93		4.894	0.200	-	-	-
2) Haulage and transport	1,106	93		2.385	0.200	2	5	14
3) Movement of personnel	1,272	33		2.744	0.071	-	-	-
4) Machinery, handling of tools and supports	576	13		1.242	0.028	-	-	-
5) Falling objects	1,503	25		3.242	0.054	-	-	-
6) Explosives and fumes	3	1		0.006	0.002	-	-	-
7) Explosions of firedamp or coal dust	-	1		-	0.002	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	4		-	0.009	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	4	2		0.009	0.004	-	-	-
12) Other causes	221	8		0.477	0.017	-	-	-
TOTAL	6,954	273	463,618,556	14.999	0.589	2	5	14

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1964
Country: Belgium

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS

AT MINES IN THE E.C.S.C. COUNTRIES

Coal-field: Charleroi-Namur

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	133	8		4.894	0.294	-	-	-
2) Haulage and transport	99	3		3.644	0.110	-	-	-
3) Movement of personnel	38	1		1.399	0.037	-	-	-
4) Machinery, handling of tools and supports	74	-		2.723	-	-	-	-
5) Falling objects	10	-		0.368	-	-	-	-
6) Explosives and fumes	1	-		0.037	-	-	-	-
7) Explosions of firedamp or coal dust	1	-		0.037	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	-	-		-	-	-	-	-
12) Other causes	15	1		0.552	0.037	-	-	-
TOTAL	371	13	27,171,160	13.654	0.478	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1964
Country: Belgium
Coal-field: Liège

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	91	6		4.512	0.297	-	-	-
2) Haulage and transport	73	2		3.619	0.099	-	-	-
3) Movement of personnel	23	-		1.140	-	-	-	-
4) Machinery, handling of tools and supports	26	-		1.289	-	-	-	-
5) Falling objects	7	1		0.347	0.050	-	-	-
6) Explosives and fumes	1	-		0.050	-	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	-	-		-	-	-	-	-
12) Other causes	5	-		0.248	-	-	-	-
TOTAL	226	9	20,167,000	11.205	0.446	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1964
Country: Belgium

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Coal-field: Borinage/Centre

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	113	2		7.892	0.140	-	-	-
2) Haulage and transport	85	2		5.936	0.140	-	-	-
3) Movement of personnel	19	1		1.327	0.069	-	-	-
4) Machinery, handling of tools and supports	62	-		4.330	-	-	-	-
5) Falling objects	14	-		0.978	-	-	-	-
6) Explosives and fumes	-	-		-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	-	-		-	-	-	-	-
12) Other causes	6	-		0.419	-	-	-	-
TOTAL	299	5	14,318,008	20.882	0.349	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS

AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1964
Country: Belgium

Coal-field: South

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	337	16		5.463	0.259	-	-	-
2) Haulage and transport	257	7		4.166	0.114	-	-	-
3) Movement of personnel	80	2		1.297	0.032	-	-	-
4) Machinery, handling of tools and supports	162	-		2.626	-	-	-	-
5) Falling objects	31	1		0.503	0.016	-	-	-
6) Explosives and fumes	2	-		0.032	-	-	-	-
7) Explosions of firedamp or coal dust	1	-		0.016	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	-	-		-	-	-	-	-
12) Other causes	26	1		0.421	0.016	-	-	-
TOTAL	896	27	61,656,168	14.524	0.437	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1964
Country: Belgium
Coal-field: Campine

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	141	8		3.033	0.172	-	-	-
2) Haulage and transport	113	11		2.431	0.237	-	-	-
3) Movement of personnel	24	1		0.516	0.022	-	-	-
4) Machinery, handling of tools and supports	88	2		1.893	0.043	-	-	-
5) Falling objects	12	1		0.258	0.021	-	-	-
6) Explosives and fumes	-	-		-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	-	1		-	0.021	-	-	-
12) Other causes	3	-		0.064	-	-	-	-
TOTAL	381	24	46,488,160	8.195	0.516	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1964
Country: Belgium

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Coal-field: Total for Kingdom

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	478	24		4.417	0.222	-	-	-
2) Haulage and transport	370	18		3.419	0.166	-	-	-
3) Movement of personnel	104	3		0.961	0.028	-	-	-
4) Machinery, handling of tools and supports	250	2		2.310	0.018	-	-	-
5) Falling objects	43	2		0.397	0.018	-	-	-
6) Explosives and fumes	2	-		0.018	-	-	-	-
7) Explosions of firedamp or coal dust	1	-		0.009	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	-	1		-	0.009	-	-	-
12) Other causes	29	1		0.268	0.009	-	-	-
TOTAL	1,277	51	108,144,328	11.799	0.471	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1964
Country: France

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS

AT MINES IN THE E.C.S.C. COUNTRIES

Coal-field: Nord/Pas-de-Calais

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	583	16		4.382	0.119	-	-	-
2) Haulage and transport	278	20		2.089	0.149	-	-	-
3) Movement of personnel	264	2		1.984	0.015	-	-	-
4) Machinery, handling of tools and supports	340	7		2.555	0.053	-	-	-
5) Falling objects	263	1		1.977	0.008	-	-	-
6) Explosives and fumes	1	1		0.008	0.008	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	1		-	0.008	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	1	-		0.008	-	-	-	-
12) Other causes	23	1		0.173	0.008	-	-	-
TOTAL	1,753	49	133,047,136	13.176	0.368	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS

AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1964
Country: France
Coal-field: Centre-Midi (not including Provence)

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	184	6		4.243	0.138	-	-	-
2) Haulage and transport	119	8		2.743	0.185	-	-	-
3) Movement of personnel	113	-		2.605	-	-	-	-
4) Machinery, handling of tools and supports	268	1		6.178	0.023	-	-	-
5) Falling objects	94	2		2.167	0.046	-	-	-
6) Explosives and fumes	2	-		0.046	-	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	1		-	0.023	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	3	-		0.009	-	-	-	-
11) Electricity	-	-		-	-	-	-	-
12) Other causes	20	2		0.461	0.046	-	-	-
TOTAL	803	20	43,376,696	18.512	0.461	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS

AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1964
Country: France

Coal-field: Lorraine

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	182	6		4.147	0.137	-	-	-
2) Haulage and transport	105	3		2.392	0.068	-	-	-
3) Movement of personnel	148	-		3.371	-	-	-	-
4) Machinery, handling of tools and supports	62	-		1.412	-	-	-	-
5) Falling objects	100	1		2.278	0.023	-	-	-
6) Explosives and fumes	-	-		-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	1	-		0.023	-	-	-	-
12) Other causes	7	-		0.159	-	-	-	-
TOTAL	605	10	43,895,512	13.782	0.228	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1964
Country: France
Coal-field: (not including Provence)

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties: Disablements as under (a) below	Number of casualties: Fatalities as under (b) below	Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below: Number of accidents	Group accidents as under (c) below: Number of disablements as under (a)	Group accidents as under (c) below: Number of fatalities as under (b)
1) Falls of ground	949	28		4.308	0.127	-	-	-
2) Haulage and transport	502	31		2.278	0.141	-	-	-
3) Movement of personnel	525	2		2.383	0.009	-	-	-
4) Machinery, handling of tools and supports	670	8		3.042	0.036	-	-	-
5) Falling objects	457	4		2.074	0.018	-	-	-
6) Explosives and fumes	3	1		0.013	0.005	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	2		-	0.009	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	3	-		0.018	-	-	-	-
11) Electricity	2	-		0.009	-	-	-	-
12) Other causes	50	3		0.227	0.014	-	-	-
TOTAL	3,161	79	220,319,344	14.347	0.359	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

Year: 1964
Country: Italy
Coal-field: Sulcis

CAUSE	Number of casualties: Disablements as under (a) below	Number of casualties: Fatalities as under (b) below	Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below: Number of accidents	Group accidents as under (c) below: Number of disablements as under (a)	Group accidents as under (c) below: Number of fatalities as under (b)
1) Falls of ground	2	-		0.893	-	-	-	-
2) Haulage and transport	4	-		1.787	-	-	-	-
3) Movement of personnel	4	-		1.787	-	-	-	-
4) Machinery, handling of tools and supports	7	-		3.127	-	-	-	-
5) Falling objects	8	-		3.574	-	-	-	-
6) Explosives and fumes	-	-		-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	-	-		-	-	-	-	-
12) Other causes	-	-		-	-	-	-	-
TOTAL	25	-	2,238,436	11.168	-	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

Year: 1964
Country: Netherlands
Coal-field: Limbourg

COMMON STATISTICAL SUMMARY OF UNDERGROUND ACCIDENTS
AT MINES IN THE E.C.S.C. COUNTRIES

CAUSE	Number of casualties		Man-hours worked	Number of disablements as under (a) per million man-hours (to third decimal place)	Number of fatalities as under (b) per million man-hours (to third decimal place	Group accidents as under (c) below		
	Disablements as under (a) below	Fatalities as under (b) below				Number of accidents	Number of disablements as under (a)	Number of fatalities as under (b)
1) Falls of ground	94	2		2.017	0.043	-	-	-
2) Haulage and transport	91	8		1.952	0.172	-	-	-
3) Movement of personnel	22	-		0.472	-	-	-	-
4) Machinery, handling of tools and supports	51	2		1.094	0.043	-	-	-
5) Falling objects	43	-		0.923	-	-	-	-
6) Explosives and fumes	1	-		0.021	-	-	-	-
7) Explosions of firedamp or coal dust	-	-		-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-		-	-	-	-	-
9) Underground combustion and fires	-	-		-	-	-	-	-
10) Inrushes of water	-	-		-	-	-	-	-
11) Electricity	1	-		0.021	-	-	-	-
12) Other causes	6	-		0.129	-	-	-	-
TOTAL	309	12	46,609,424	6.629	0.257	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).

F. COMPARATIVE TABLES OF COMMON STATISTICAL SUMMARIES
1958 - 1964

A. Comparative Table of Numbers of Persons
incapacitated by Underground Accidents for eight weeks or longer
For the years 1958 - 1964
per million man-hours

CAUSE	Germany (North-Rhine/Westphalia and Saar)				Belgium				France (excluding Provence)				Italy				Netherlands				Community			
(1958 - 1961)	1958	1959	1960	1961	1958	1959	1960	1961	1958	1959	1960	1961	1958	1959	1960	1961	1958	1959	1960	1961	1958	1959	1960	1961
1) Falls of ground	4,843	4,779	4,886	4,797	5,911	4,294	4,324	4,071	5,027	4,665	4,774	4,416	1,355	1,378	1,808	-	1,326	1,464	1,305	1,829	4,846	4,490	4,571	4,434
2) Haulage and Transport	2,550	2,569	2,445	2,458	4,132	2,979	2,709	2,770	1,980	1,695	1,920	2,106	1,335	0,984	1,205	0,676	1,511	1,562	1,898	1,924	2,602	2,347	2,310	2,371
3) Movement of Personnel	2,497	2,463	2,348	2,512	1,354	0,998	1,008	1,062	1,505	1,118	2,873	2,334	0,668	0,394	1,005	1,578	0,324	0,386	0,187	0,514	2,003	1,823	2,185	2,185
4) Machinery, Handling of tools and supports	0,767	0,914	0,920	0,867	2,804	2,085	2,386	2,097	0,914	1,022	1,621	2,523	1,169	0,984	0,603	0,902	0,617	0,402	0,780	0,915	1,098	1,064	1,264	1,423
5) Falling Objects	2,537	2,719	2,738	2,945	0,414	0,371	0,354	0,301	1,890	2,187	1,893	2,292	1,169	1,968	1,808	2,029	0,401	0,515	0,492	0,819	1,962	2,161	2,105	2,353
6) Explosives and fumes	0,015	0,011	0,010	0,009	0,027	0,007	0,032	0,018	0,043	0,051	0,031	0,017	0,167	-	-	0,225	-	-	-	-	0,023	0,020	0,017	0,012
7) Explosions of firedamp or coal dust	0,011	0,016	-	0,002	-	-	-	-	0,047	0,088	-	-	-	-	-	-	-	-	-	-	0,017	0,030	0,010	0,001
8) Sudden outburst of firedamp, suffocation by natural gases	-	-	-	-	0,011	-	-	-	0,004	-	-	-	-	-	-	-	-	-	-	-	0,002	-	-	-
9) Underground combustion and fires	-	-	0,003	0,002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,002	0,001
10) Inrushes of water	0,004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,002	-	-	-
11) Electricity	0,010	0,014	0,012	0,014	0,011	-	0,015	0,018	0,014	-	0,004	0,029	-	-	-	-	-	-	-	-	0,010	0,008	0,010	0,018
12) Other Causes	0,487	0,522	0,457	0,503	0,260	0,255	0,260	0,301	2,956	2,768	0,793	0,362	0,334	0,591	0,603	0,451	0,262	0,161	0,390	0,210	0,985	1,012	0,513	0,428
TOTAL	13,721	14,007	13,819	14,109	14,924	10,989	11,089	10,638	14,380	13,594	13,909	14,079	6,197	6,299	7,032	5,861	4,441	4,490	5,051	6,212	13,551	12,954	12,986	13,227
(1962 - 1964)	1962	1963	1964	1965	1962	1963	1964	1965	1962	1963	1964	1965	1962	1963	1964	1965	1962	1963	1964	1965	1962	1963	1964	1965
1) Falls of ground	4,682	4,663	4,894	-	4,439	4,432	4,417	-	4,222	4,177	4,308	-	0,792	0,366	0,893	-	2,238	1,742	2,017	-	4,387	4,337	4,509	-
2) Haulage and Transport	2,501	2,433	2,385	-	3,331	3,565	3,419	-	2,196	2,364	2,278	-	1,847	1,465	1,787	-	2,590	1,826	1,952	-	2,521	2,520	2,346	-
3) Movement of Personnel	2,608	2,646	2,744	-	1,136	1,066	0,961	-	2,458	2,368	2,383	-	1,056	0,732	1,787	-	0,580	0,630	0,472	-	2,282	2,261	2,326	-
4) Machinery, Handling of tools and supports	1,046	1,213	1,242	-	2,461	2,414	2,310	-	2,991	3,096	3,042	-	1,584	1,465	3,127	-	1,015	1,050	1,094	-	1,712	1,818	1,848	-
5) Falling Objects	3,077	3,038	3,242	-	0,445	0,547	0,397	-	2,073	2,278	2,074	-	2,375	3,296	3,574	-	0,642	0,630	0,923	-	2,375	2,406	2,442	-
6) Explosives and fumes	0,008	0,006	0,006	-	-	0,019	0,018	-	0,051	0,009	0,013	-	-	0,366	-	-	-	-	0,021	-	0,018	0,010	0,011	-
7) Explosives of firedamp or coal dust	0,123	0,010	-	-	-	-	0,009	-	0,004	-	-	-	-	-	-	-	-	-	-	-	0,071	0,006	0,001	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10) Inrushes of water	-	0,004	-	-	0,010	-	-	-	-	-	0,018	-	-	-	-	-	-	-	-	-	0,001	0,002	0,003	-
11) Electricity	0,006	0,012	0,009	-	0,010	0,009	-	-	0,004	0,014	0,009	-	-	-	-	-	0,021	-	0,021	-	0,007	0,012	0,008	-
12) Other Causes	0,488	0,473	0,477	-	0,331	0,198	0,268	-	0,240	0,354	0,227	-	-	-	-	-	0,497	0,147	0,129	-	0,404	0,390	0,364	-
TOTAL	14,539	14,499	14,999	-	12,161	12,250	11,799	-	14,239	14,660	14,347	-	7,654	7,690	11,168	-	7,583	6,025	6,629	-	13,781	13,761	13,860	-

B. Comparative Table of accidents
<u>resulting in death within eight weeks</u> for
the years 1958 to 1964
per million man-hours

CAUSE	Germany (North-Rhine/Westphalia and Saar)				Belgium				France (excluding Provence)				Italy				Netherlands				Community			
(1958 - 1961)	1958	1959	1960	1961	1958	1959	1960	1961	1958	1959	1960	1961	1958	1959	1960	1961	1958	1959	1960	1961	1958	1959	1960	1961
1) Falls of ground	0,268	0,290	0,263	0,216	0,223	0,213	0,299	0,266	0,235	0,192	0,186	0,219	0,167	-	0,201	0,225	0,262	0,064	0,034	0,114	0,253	0,242	0,235	0,217
2) Haulage and Transport	0,179	0,169	0,182	0,196	0,101	0,124	0,157	0,168	0,115	0,085	0,082	0,122	-	0,197	-	-	0,077	0,145	0,067	0,095	0,147	0,141	0,146	0,168
3) Movement of Personnel	0,094	0,097	0,070	0,086	0,011	0,027	0,008	0,035	0,007	0,018	0,027	0,008	-	-	-	-	-	-	-	-	0,057	0,063	0,047	0,056
4) Machinery, Handling of tools and supports	0,010	0,027	0,012	0,027	0,005	0,014	0,016	0,027	0,018	0,040	0,016	0,008	-	-	-	-	0,015	0,016	-	-	0,011	0,028	0,012	0,021
5) Falling Objects	0,065	0,041	0,039	0,065	0,016	-	0,008	-	0,025	0,007	0,004	0,017	-	0,197	-	-	-	0,016	-	-	0,045	0,027	0,024	0,041
6) Explosives and fumes	0,009	0,003	0,003	-	0,011	0,014	-	-	-	0,026	-	-	0,501	-	-	-	-	-	-	-	0,009	0,010	0,002	-
7) Explosions of firedamp or coal dust	0,011	0,012	-	-	-	-	0,016	-	0,115	0,121	-	-	-	-	-	-	-	-	-	-	0,032	0,036	0,002	-
8) Sudden outbursts of firedamp, suffocation by natural gases	0,005	0,003	0,002	0,004	0,016	0,014	-	-	0,043	0,026	0,019	0,004	0,167	-	-	-	-	-	-	-	0,016	0,010	0,006	0,003
9) Underground combustion and fires	-	0,003	-	0,002	-	0,007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,003	-	0,001
10) Inrushes of water	-	0,003	0,002	-	0,011	-	-	0,044	-	-	-	0,004	-	-	-	-	-	-	-	-	0,002	0,002	0,001	0,006
11) Electricity	0,022	0,008	0,002	0,005	0,021	-	0,024	-	-	0,011	0,012	-	-	-	-	-	-	-	-	0,019	0,016	0,007	0,007	0,004
12) Other Causes	0,025	0,025	0,036	0,049	0,005	-	0,008	0,009	0,036	0,029	0,008	-	-	-	-	-	-	-	0,017	-	0,023	0,021	0,024	0,029
TOTAL	0,687	0,680	0,611	0,651	0,420	0,413	0,536	0,549	0,594	0,555	0,354	0,382	0,835	0,394	0,201	0,225	0,355	0,241	0,119	0,229	0,610	0,590	0,507	0,546
(1962 - 1964)	1962	1963	1964	1965	1962	1963	1964	1965	1962	1963	1964	1965	1962	1963	1964	1965	1962	1963	1964	1965	1962	1963	1964	1965
1) Falls of ground	0,280	0,260	0,200	-	0,246	0,264	0,222	-	0,167	0,120	0,127	-	-	0,366	-	-	0,062	0,084	0,043	-	0,234	0,217	0,175	-
2) Haulage and Transport	0,149	0,178	0,200	-	0,142	0,245	0,166	-	0,077	0,121	0,141	-	-	-	-	-	0,062	0,105	0,172	-	0,124	0,167	0,178	-
3) Movement of Personnel	0,059	0,089	0,071	-	0,010	0,057	0,028	-	0,043	0,009	0,009	-	-	-	-	-	-	-	-	-	0,045	0,060	0,045	-
4) Machinery, Handling of tools and supports	0,037	0,019	0,028	-	0,047	-	0,018	-	0,030	0,009	0,036	-	-	-	-	-	0,041	-	0,043	-	0,037	0,013	0,030	-
5) Falling Objects	0,094	0,072	0,054	-	0,010	0,019	0,018	-	0,030	0,009	0,018	-	-	-	-	-	-	-	-	-	0,062	0,046	0,037	-
6) Explosives and fumes	0,004	-	0,002	-	-	-	-	-	-	0,005	0,005	-	-	-	-	-	-	-	-	-	0,002	0,001	0,002	-
7) Explosions of firedamp or coal dust	0,660	0,002	0,002	-	-	-	-	-	0,004	-	-	-	-	-	-	-	-	-	-	-	0,375	0,001	0,001	-
8) Sudden outbursts of firedamp, suffocation by natural gases	0,002	-	-	-	0,047	-	-	-	-	0,019	0,009	-	-	-	-	-	-	-	-	-	0,007	0,005	0,002	-
9) Underground combustion and fires	-	0,006	0,009	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,003	0,005	-
10) Inrushes of water	-	0,004	-	-	0,047	0,019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,005	0,005	-	-
11) Electricity	0,010	0,002	0,004	-	-	0,009	0,009	-	0,009	0,024	-	-	-	-	-	-	-	-	-	-	0,008	0,008	0,003	-
12) Other Causes	0,049	0,025	0,017	-	0,019	0,028	0,009	-	0,009	0,014	0,014	-	-	-	-	-	-	-	-	-	0,032	0,021	0,014	-
TOTAL	1,344	0,657	0,587	-	0,568	0,641	0,471	-	0,369	0,330	0,359	-	-	00,366	-	-	0,166	0,189	0,257	-	0,932	0,547	0,492	-

C. Comparative table of underground group accidents (see (c) below), for the years 1960 to 1964

CAUSE (1960-1962)	Germany (North-Rhine/Westphalia and Saar)									Belgium									France (excluding Provence)									Italy									Netherlands									Community								
	1960			1961			1962			1960			1961			1962			1960			1961			1962			1960			1961			1962			1960			1961			1962			1960			1961			1962		
	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b
1) Falls of ground	2	2	10	-	-	-	1	1	6	-	-	-	-	-	-	1	2	6	-	-	-	1	-	7	1	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	10	1	-	7	3	3	18
2) Haulage and Transport	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3) Movement of Personnel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4) Machinery, Handling of tools and supports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5) Falling Objects	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6) Explosives and fumes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7) Explosion of firedamp or coal dust	-	-	-	-	-	-	3	62	338	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	62	338
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11) Electricity	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12) Other Causes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	2	2	-	-	-	-	4	63	344	-	-	-	-	-	-	1	2	6	-	-	-	1	-	7	1	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	10	1	-	7	6	65	356

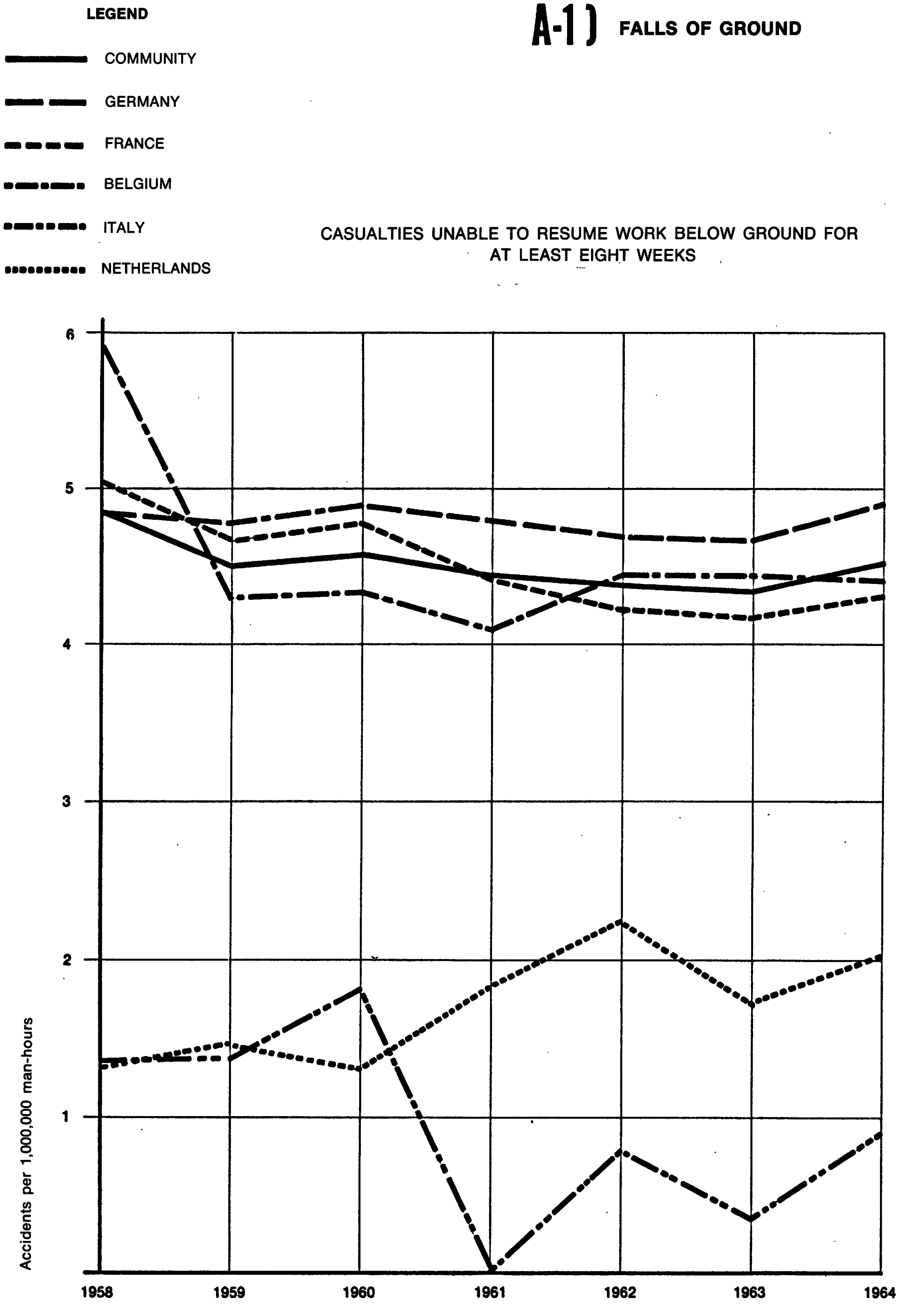
(1963-1964)	Germany (North-Rhine/Westphalia and Saar)									Belgium									France (excluding Provence)									Italy									Netherlands									Community								
	1963			1964			1965			1963			1964			1965			1963			1964			1965			1963			1964			1965			1963			1964			1965			1963			1964			1965		
	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b	N	a	b
1) Falls of ground	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2) Haulage and Transport	-	-	-	2	5	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	5	14	-	-	-
3) Movement of Personnel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4) Machinery, Handling of tools and supports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5) Falling Objects	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6) Explosives and fumes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7) Explosions of firedamp or coal dust	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8) Sudden outbursts of firedamp, suffocation by natural gases	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9) Underground combustion and fires	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10) Inrushes of water	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11) Electricity	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12) Other Causes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	-	-	-	2	5	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	5	14	-	-	-

(a) Casualties were unable to resume work below ground for at least eight weeks.
(b) Casualties died within eight weeks.
(c) Accidents involving more than five casualties of types (a) and/or (b).
(N) Number of group accidents.

G. CURVES BASED ON COMPARATIVE
TABLES OF COMMON STATISTICS
1958 - 1964

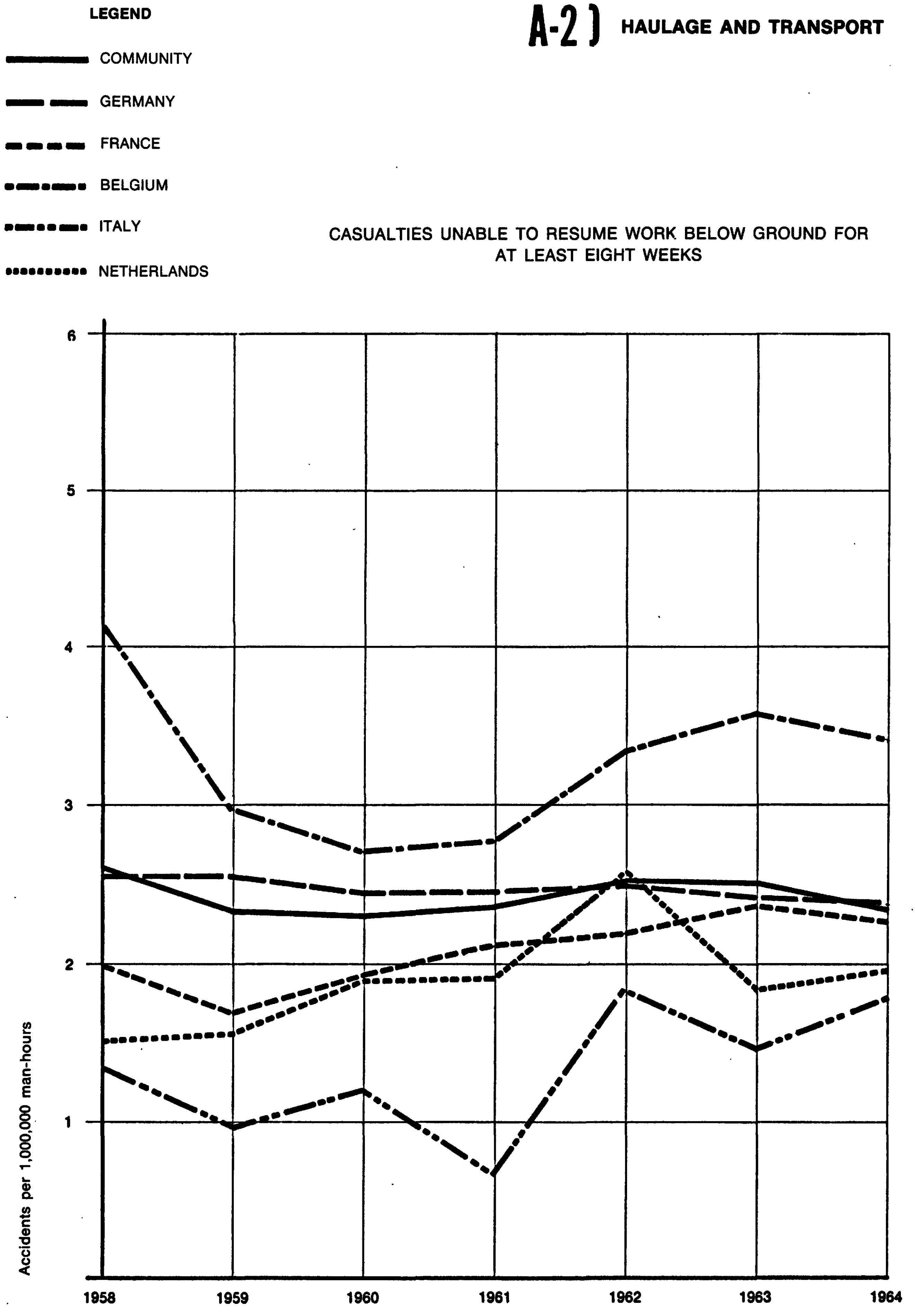
A-1) FALLS OF GROUND

CASUALTIES UNABLE TO RESUME WORK BELOW GROUND FOR AT LEAST EIGHT WEEKS



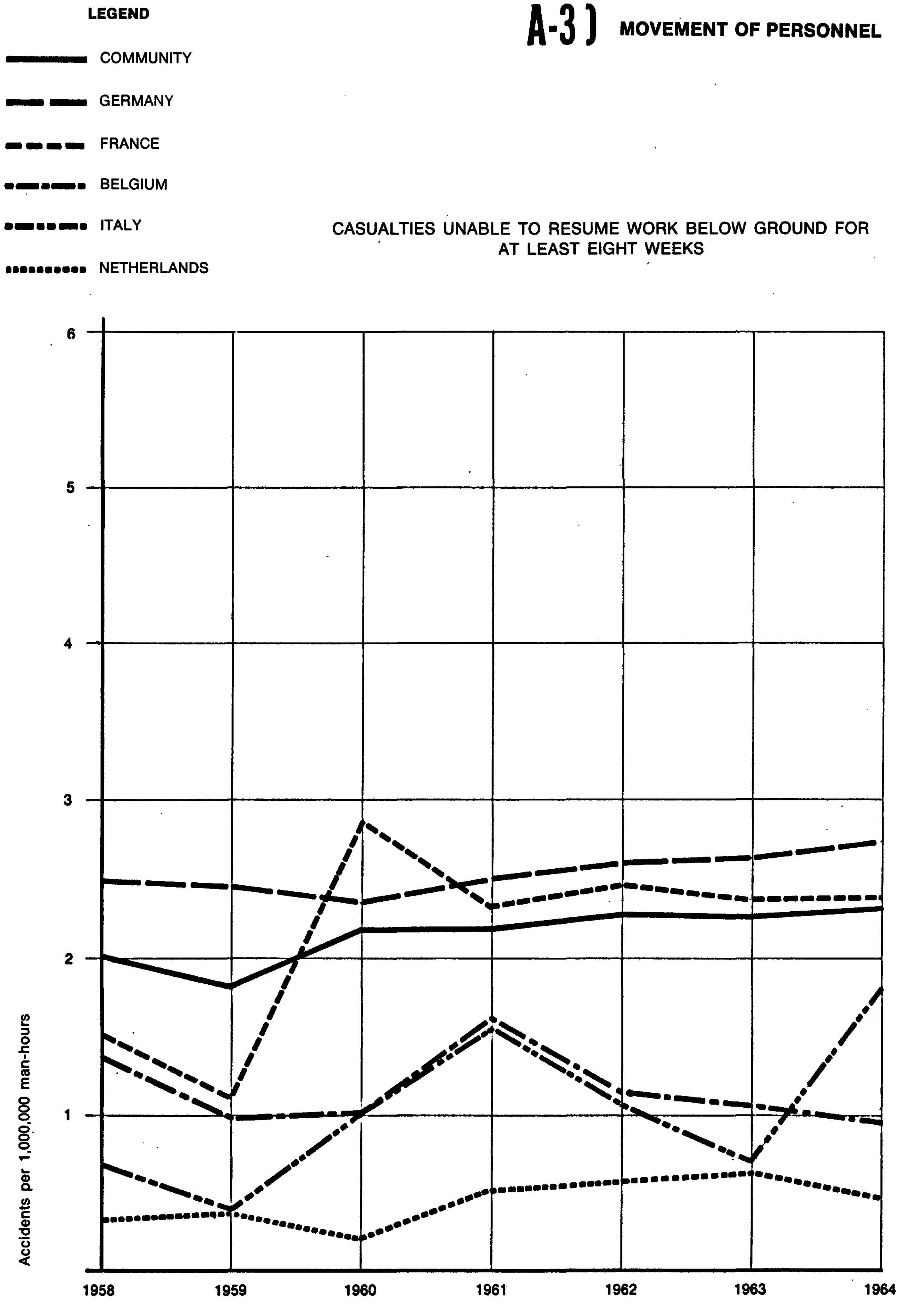
A-2) HAULAGE AND TRANSPORT

CASUALTIES UNABLE TO RESUME WORK BELOW GROUND FOR AT LEAST EIGHT WEEKS



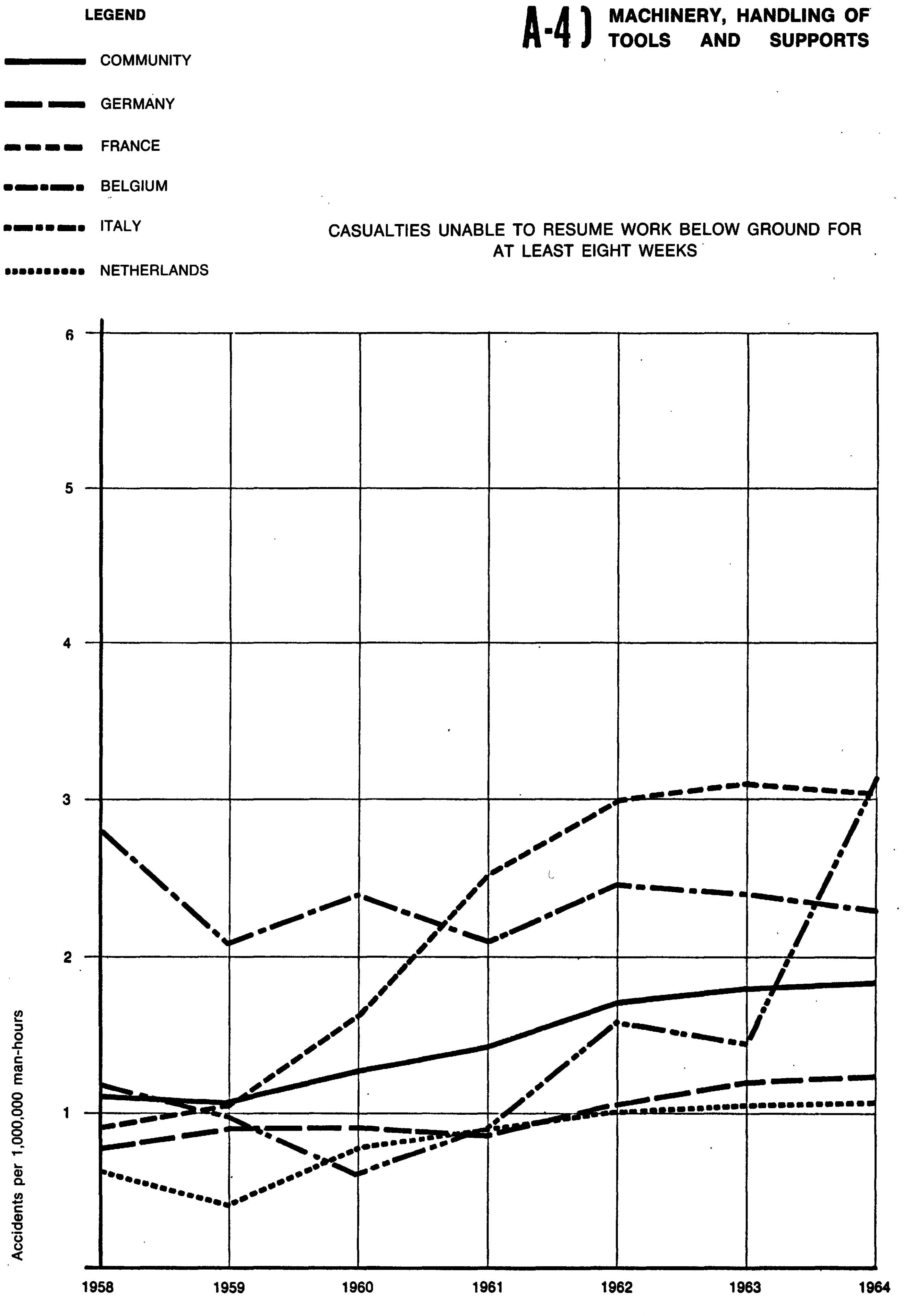
A-3) MOVEMENT OF PERSONNEL

CASUALTIES UNABLE TO RESUME WORK BELOW GROUND FOR AT LEAST EIGHT WEEKS



A-4) MACHINERY, HANDLING OF TOOLS AND SUPPORTS

CASUALTIES UNABLE TO RESUME WORK BELOW GROUND FOR AT LEAST EIGHT WEEKS



LEGEND

COMMUNITY

GERMANY

FRANCE

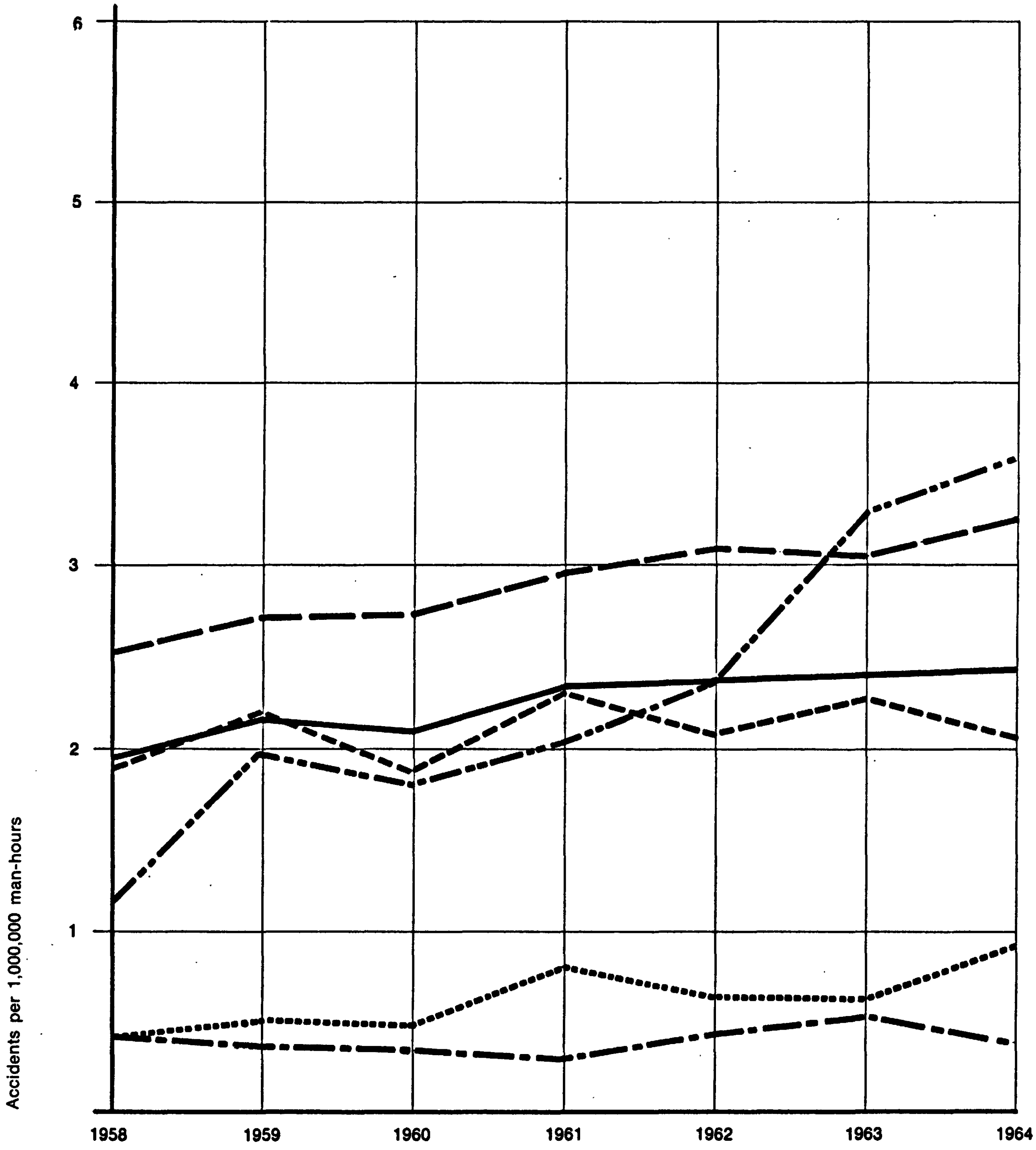
BELGIUM

ITALY

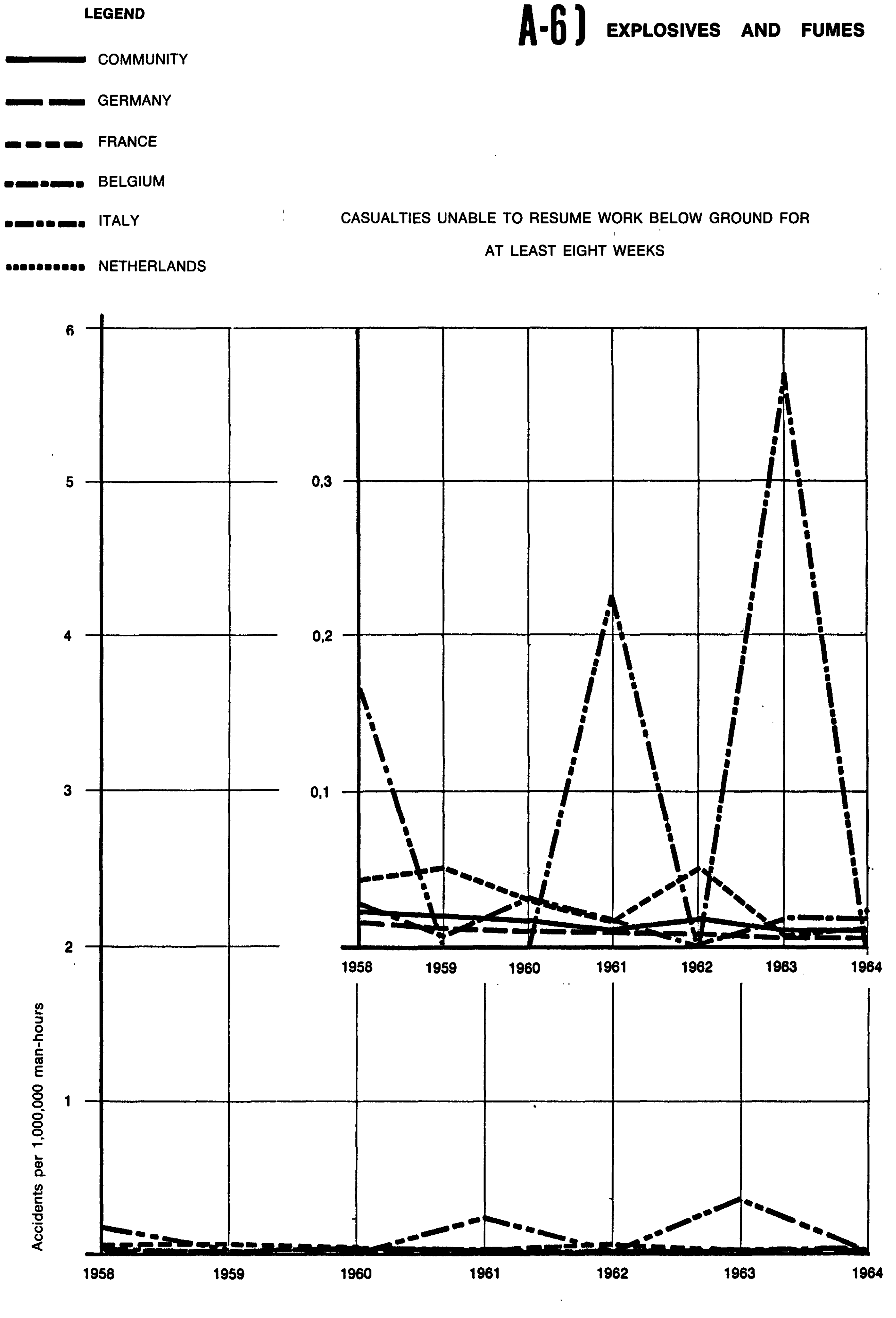
NETHERLANDS

A-5) FALLING OBJECTS

CASUALTIES UNABLE TO RESUME WORK BELOW GROUND FOR AT LEAST EIGHT WEEKS

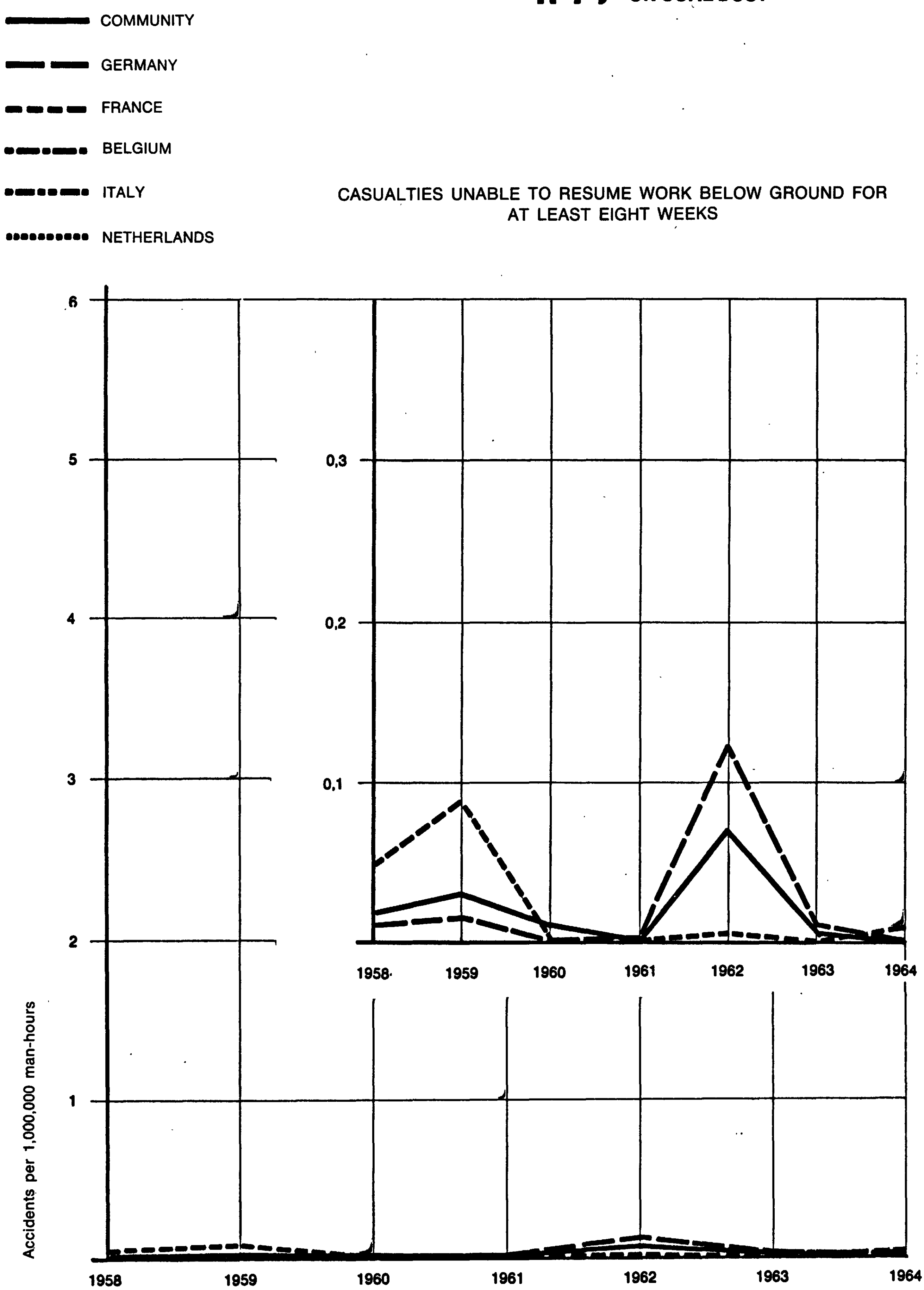


A-6) EXPLOSIVES AND FUMES



A-7) EXPLOSIONS OF FIREDAMP OR COAL DUST

CASUALTIES UNABLE TO RESUME WORK BELOW GROUND FOR AT LEAST EIGHT WEEKS



A-8) SUDDEN OUTBURSTS OF FIREDAMP, SUFFOCATION BY NATURAL GASES

A-9) UNDERGROUND COMBUSTION AND FIRES

A-10) INRUSHES OF WATER

No graph is given, the number of values available being too small

A-11) ELECTRICITY

LEGEND

COMMUNITY

GERMANY

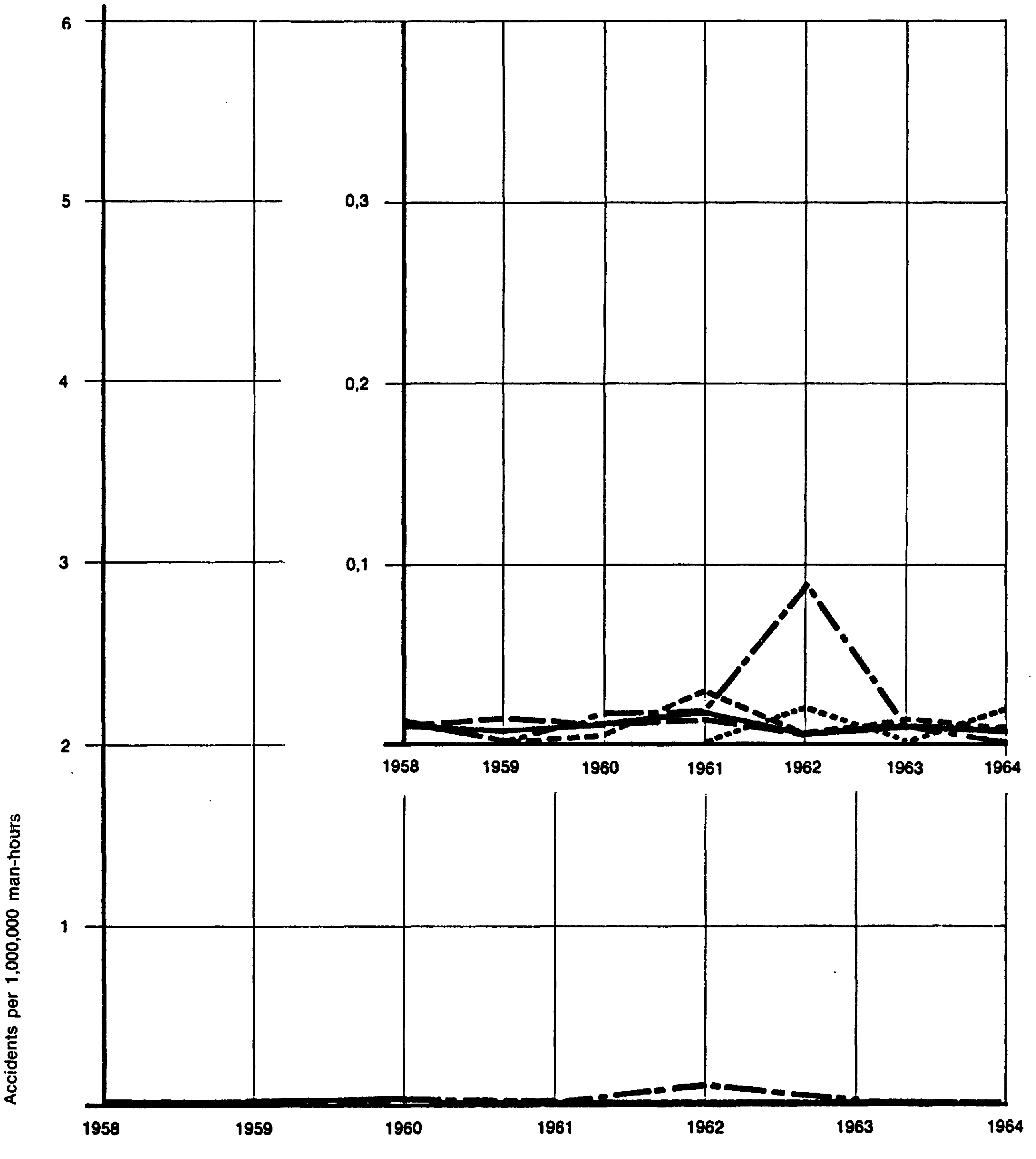
FRANCE

BELGIUM

ITALY

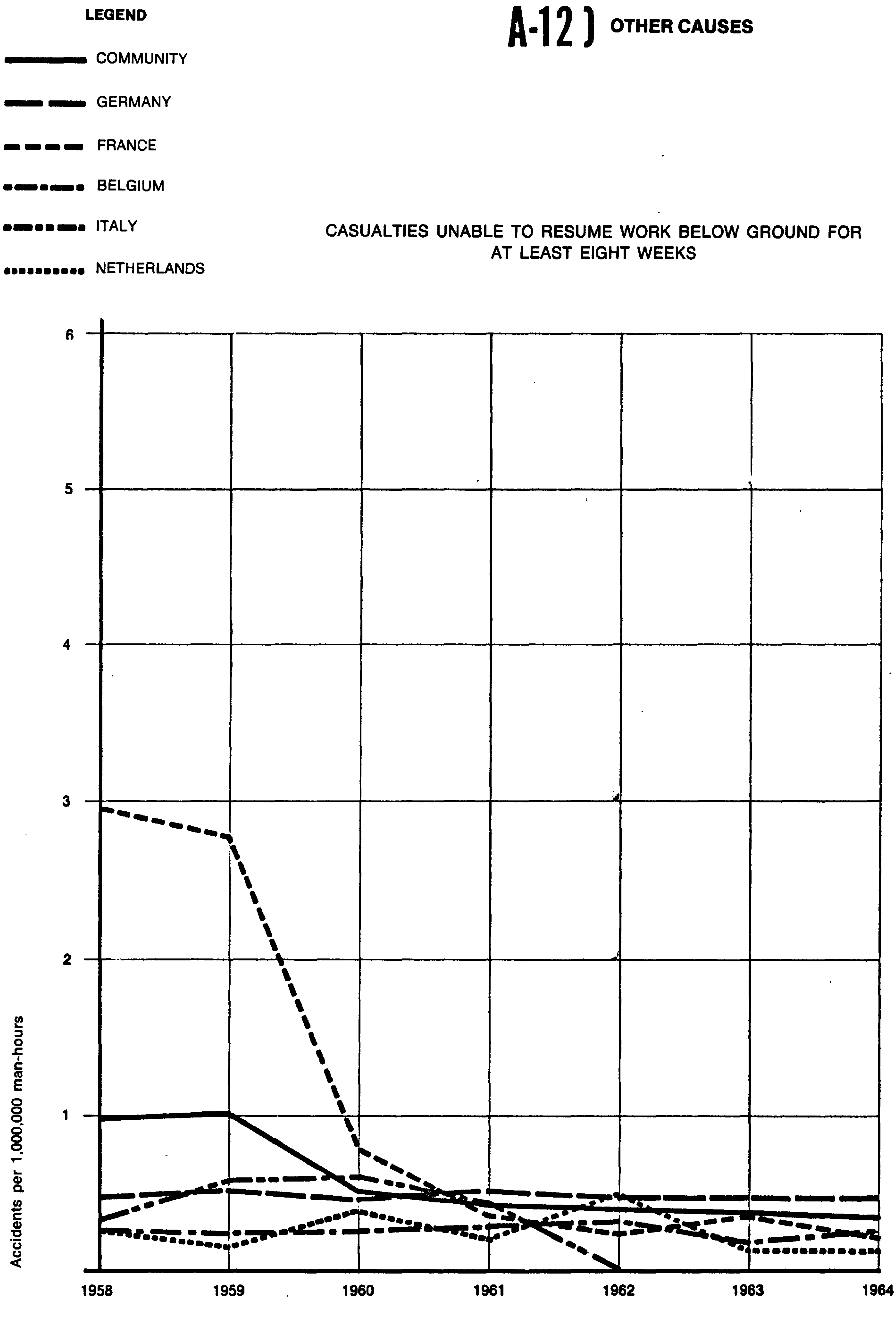
NETHERLANDS

CASUALTIES UNABLE TO RESUME WORK BELOW GROUND FOR AT LEAST EIGHT WEEKS

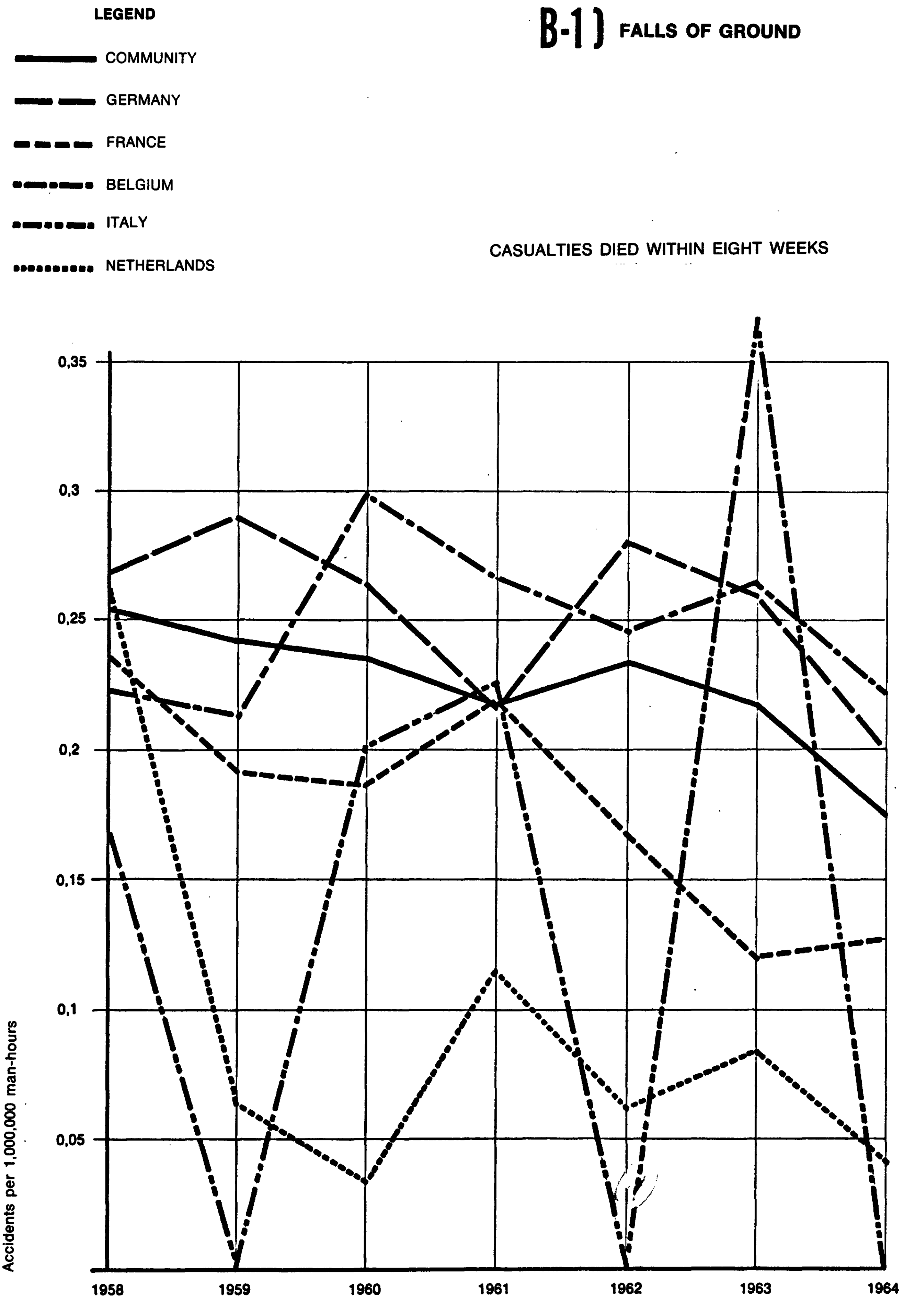


A-12) OTHER CAUSES

CASUALTIES UNABLE TO RESUME WORK BELOW GROUND FOR AT LEAST EIGHT WEEKS



B-1) FALLS OF GROUND

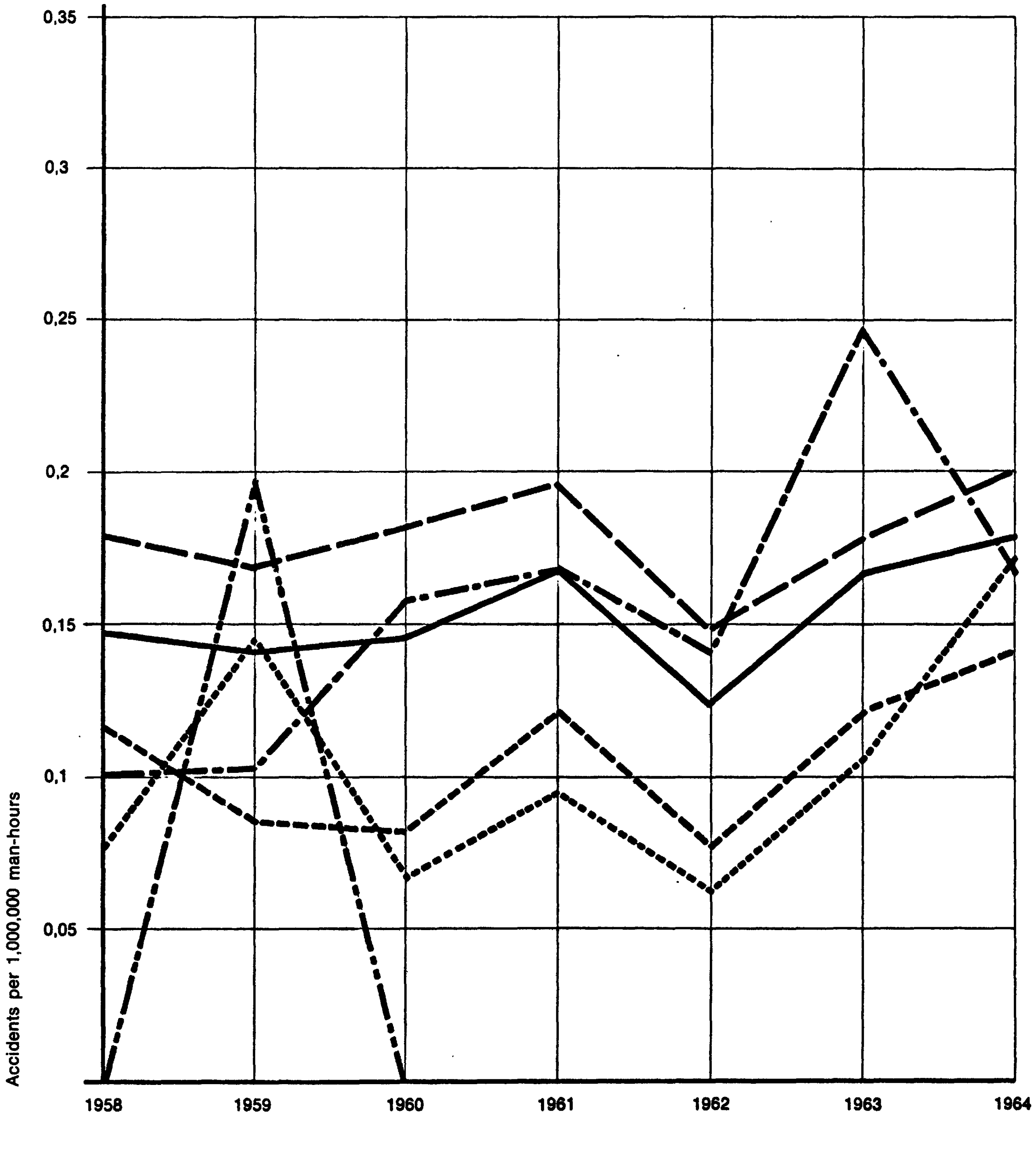


LEGEND

- COMMUNITY
- GERMANY
- FRANCE
- BELGIUM
- ITALY
- NETHERLANDS

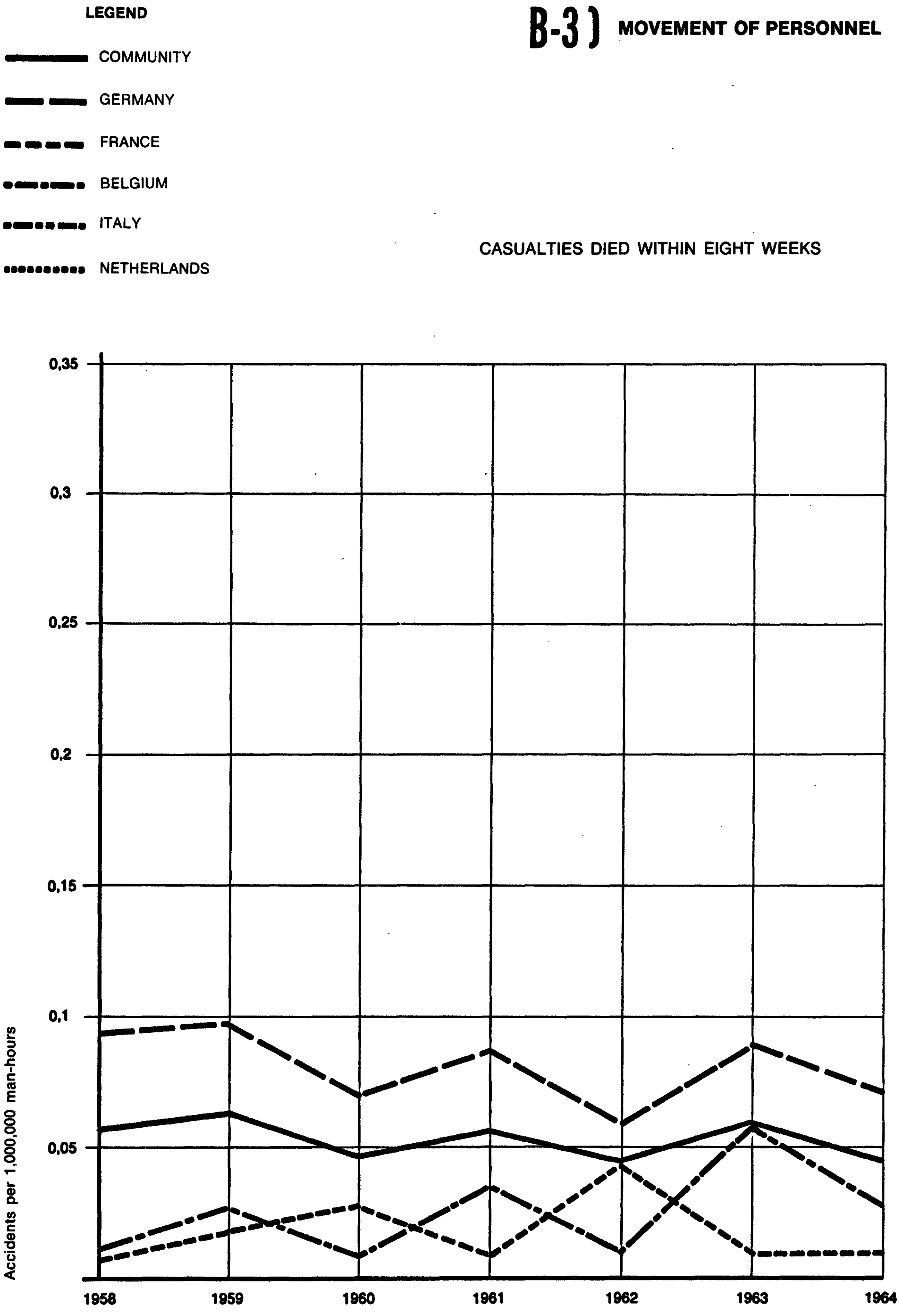
B-2) HAULAGE AND TRANSPORT

CASUALTIES DIED WITHIN EIGHT WEEKS



B-3) MOVEMENT OF PERSONNEL

CASUALTIES DIED WITHIN EIGHT WEEKS

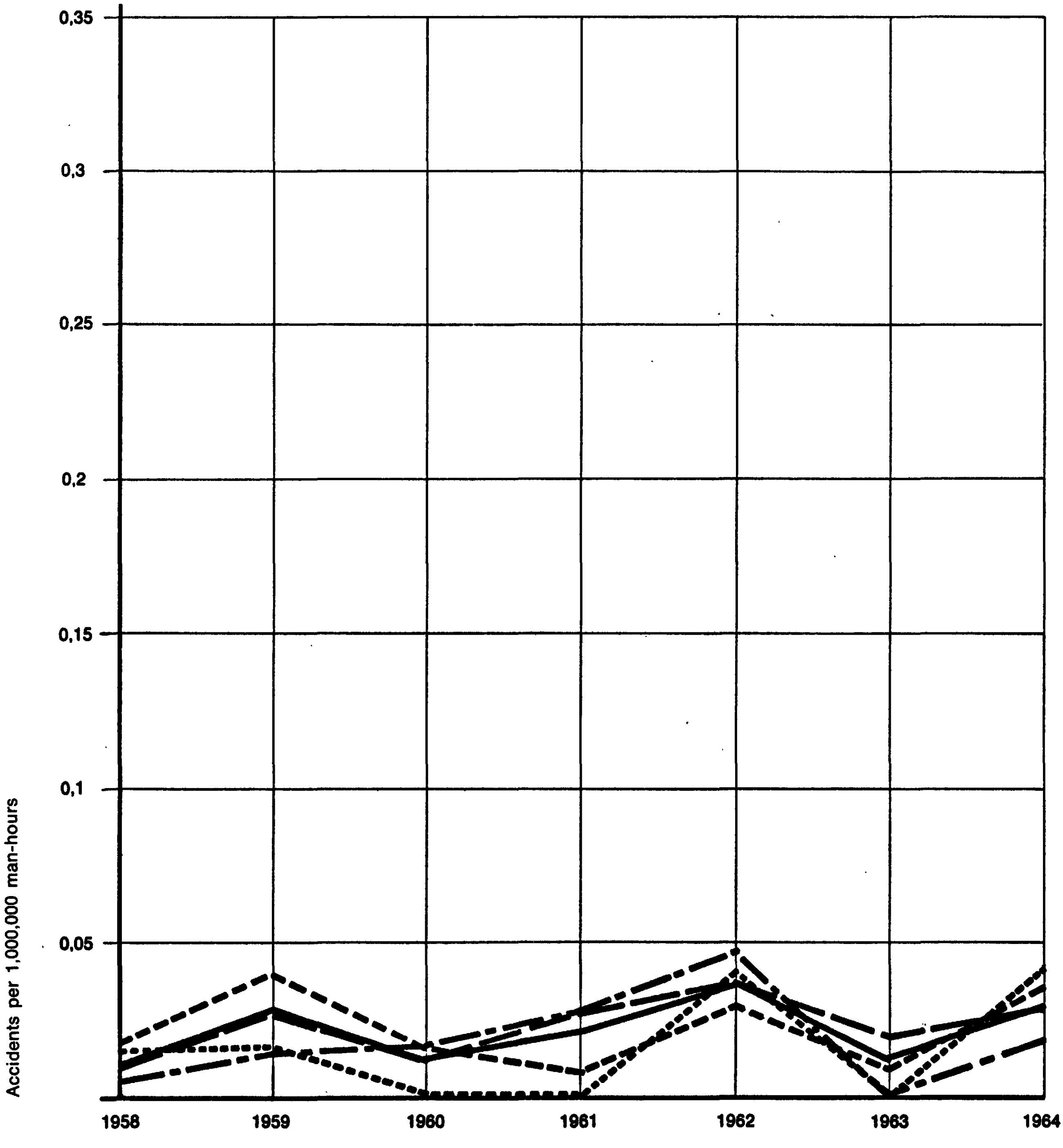


B-4) MACHINERY, HANDLING OF TOOLS AND SUPPORTS

LEGEND

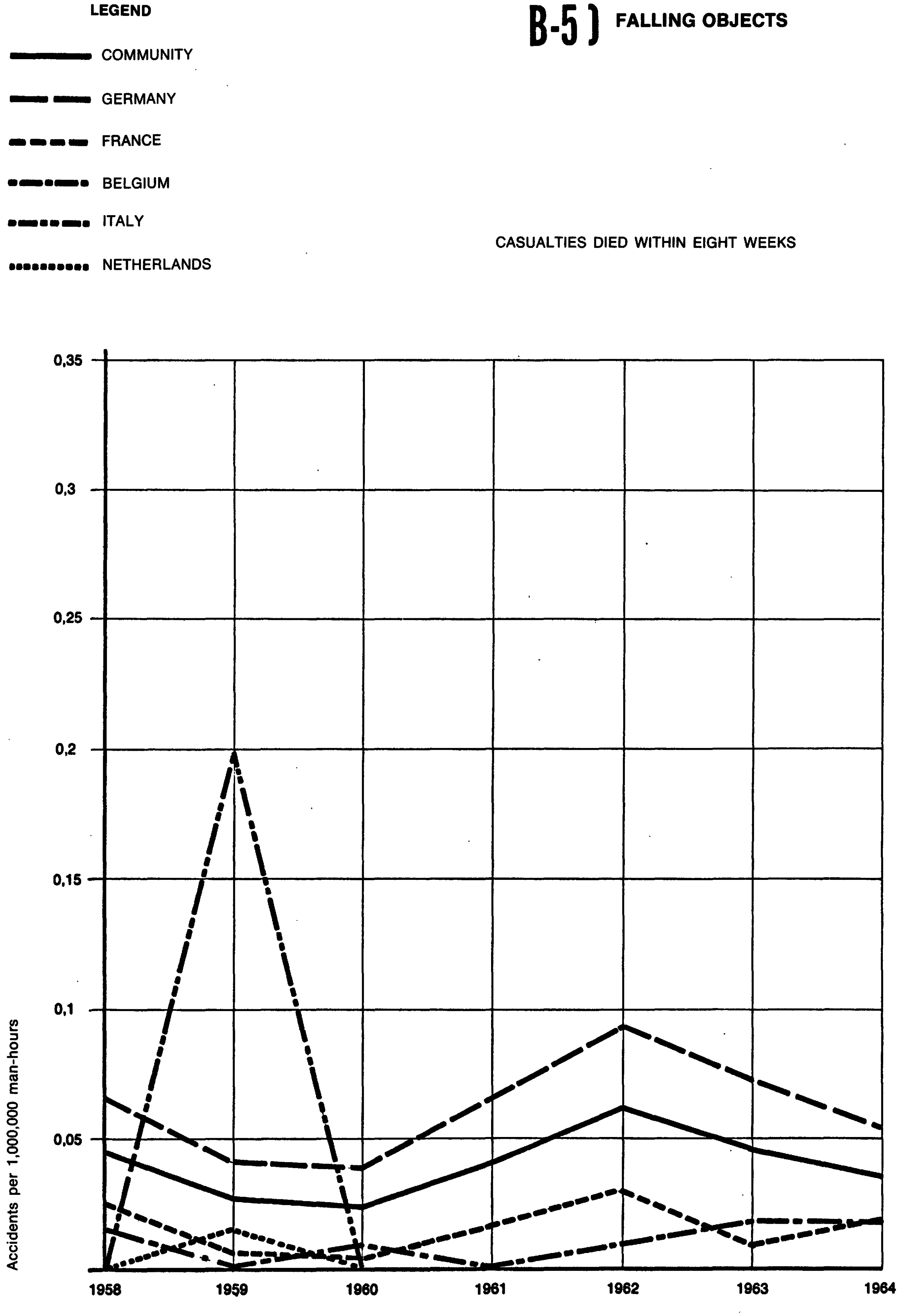
- COMMUNITY
- GERMANY
- FRANCE
- BELGIUM
- ITALY
- NETHERLANDS

CASUALTIES DIED WITHIN EIGHT WEEKS



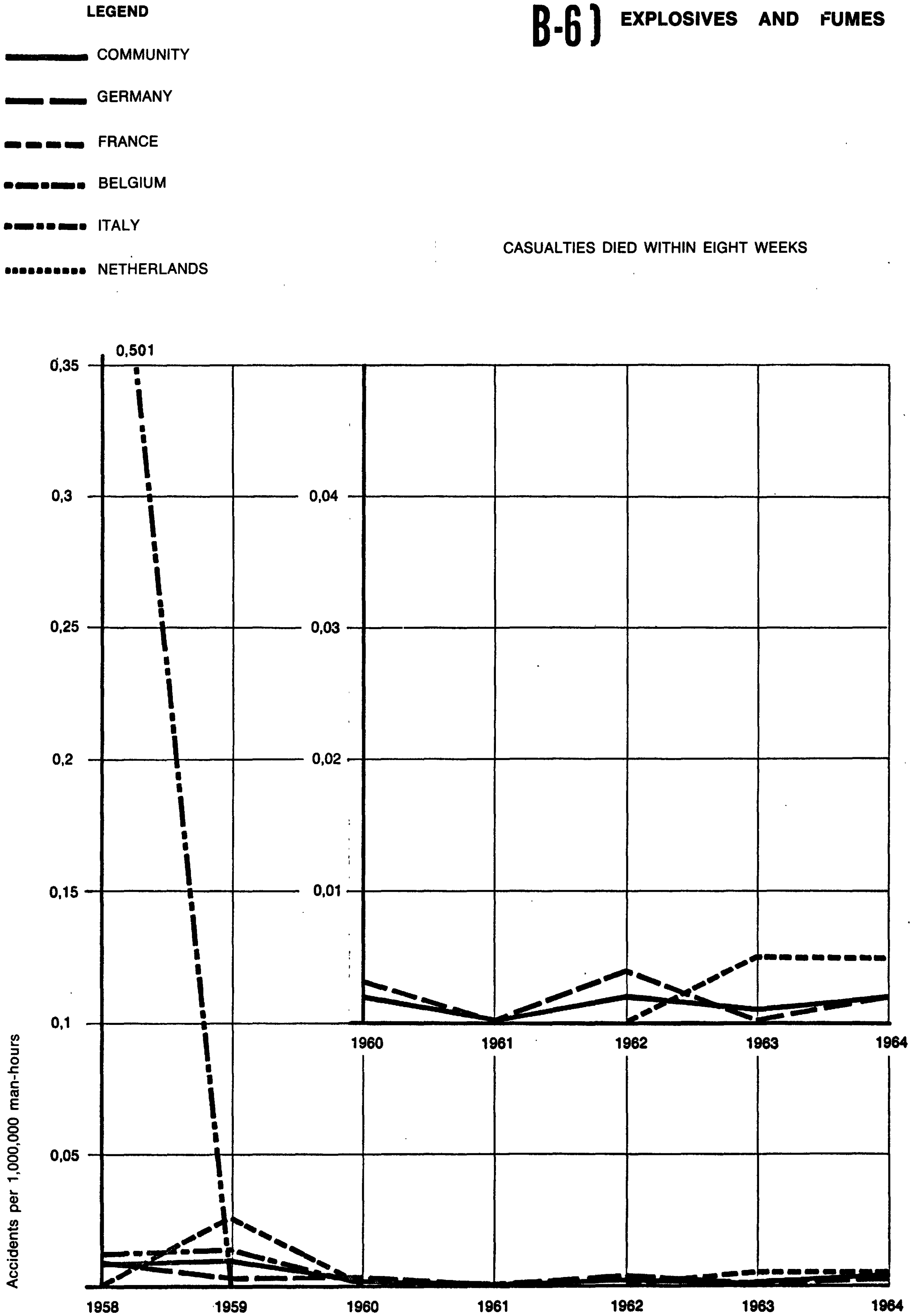
B-5) FALLING OBJECTS

CASUALTIES DIED WITHIN EIGHT WEEKS



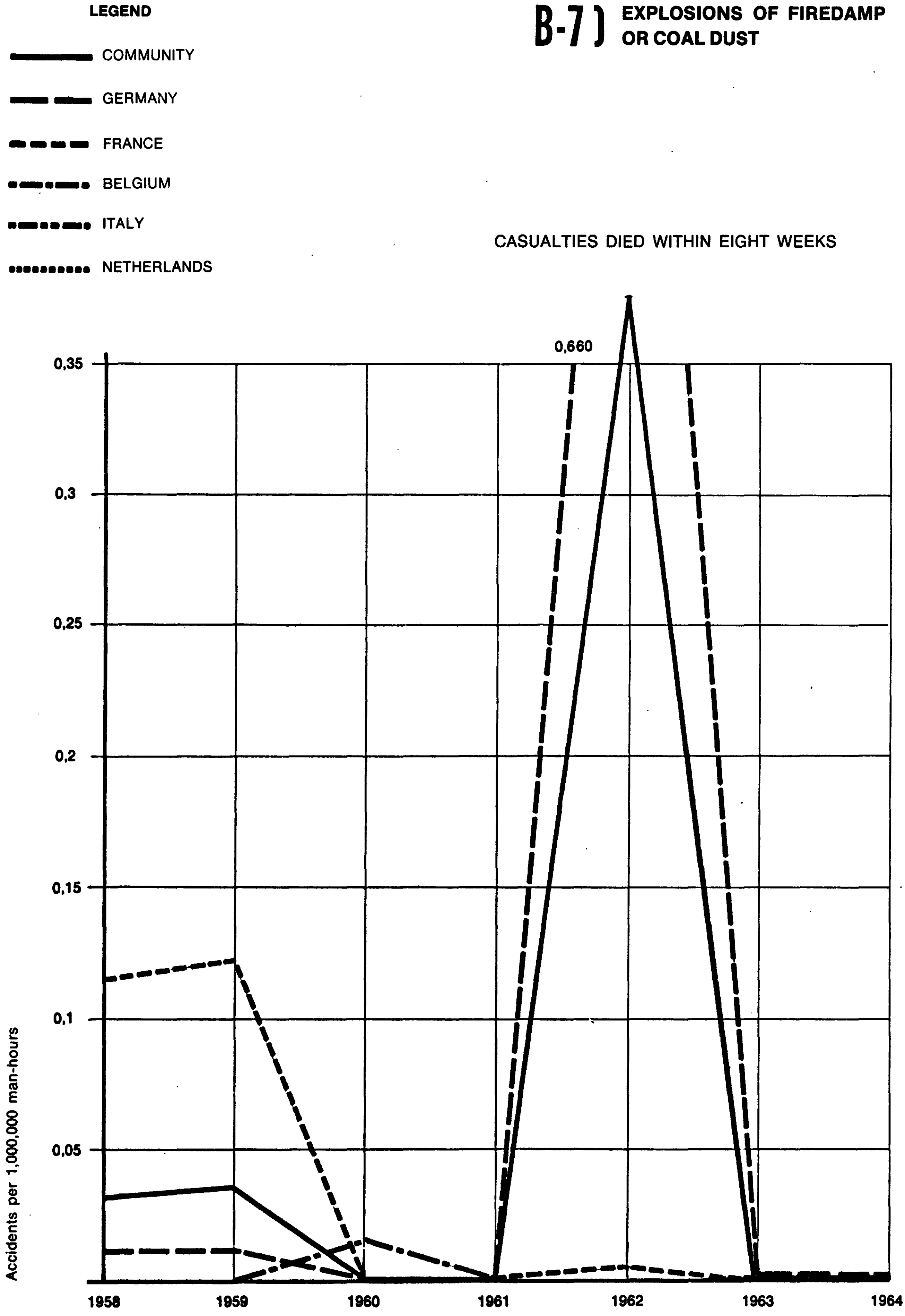
B-6) EXPLOSIVES AND FUMES

CASUALTIES DIED WITHIN EIGHT WEEKS



B-7) EXPLOSIONS OF FIREDAMP OR COAL DUST

CASUALTIES DIED WITHIN EIGHT WEEKS



LEGEND

COMMUNITY

GERMANY

FRANCE

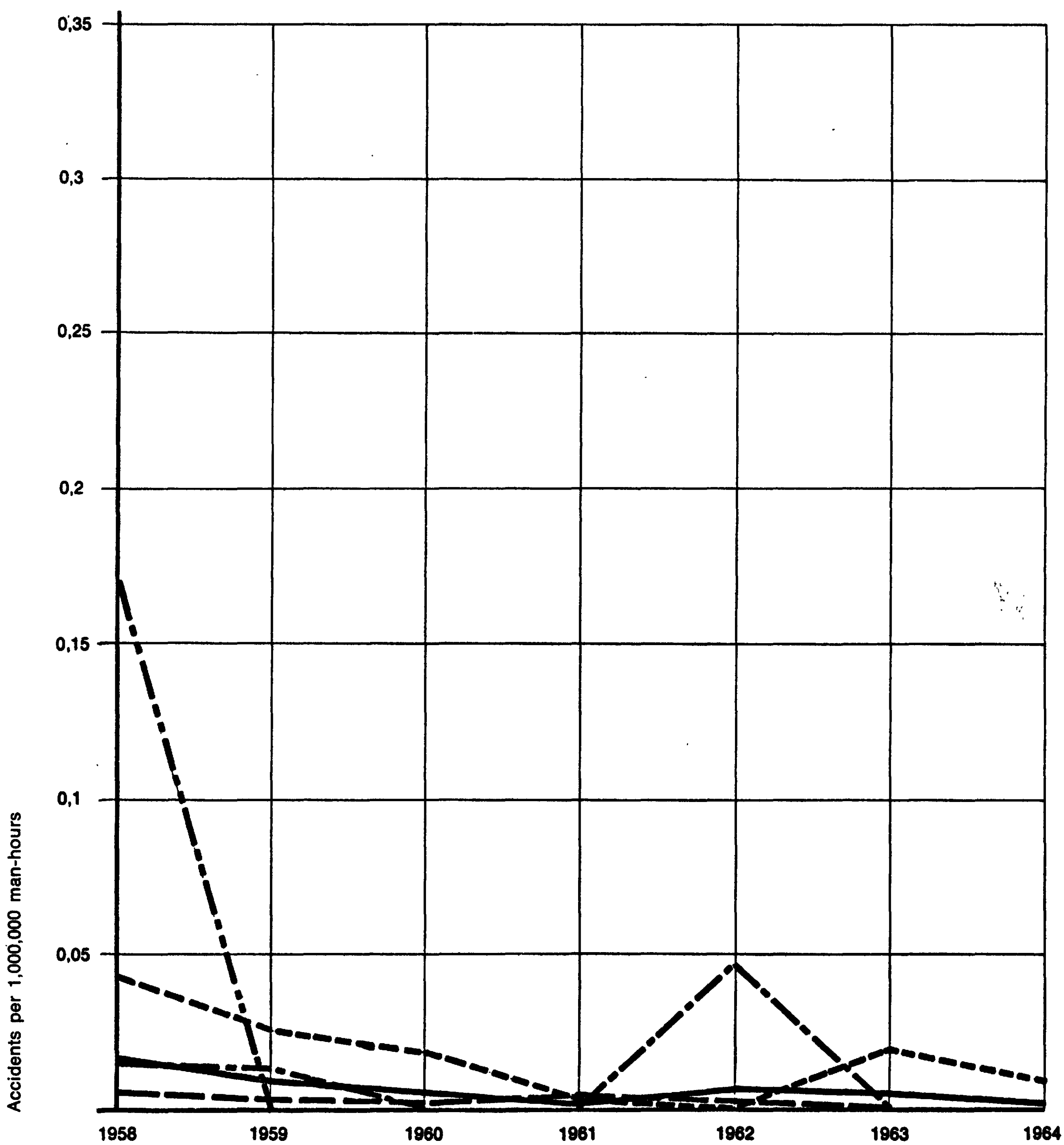
BELGIUM

ITALY

NETHERLANDS

B-8) SUDDEN OUTBURSTS OF FIREDAMP, SUFFOCATION BY NATURAL GASES

CASUALTIES DIED WITHIN EIGHT WEEKS

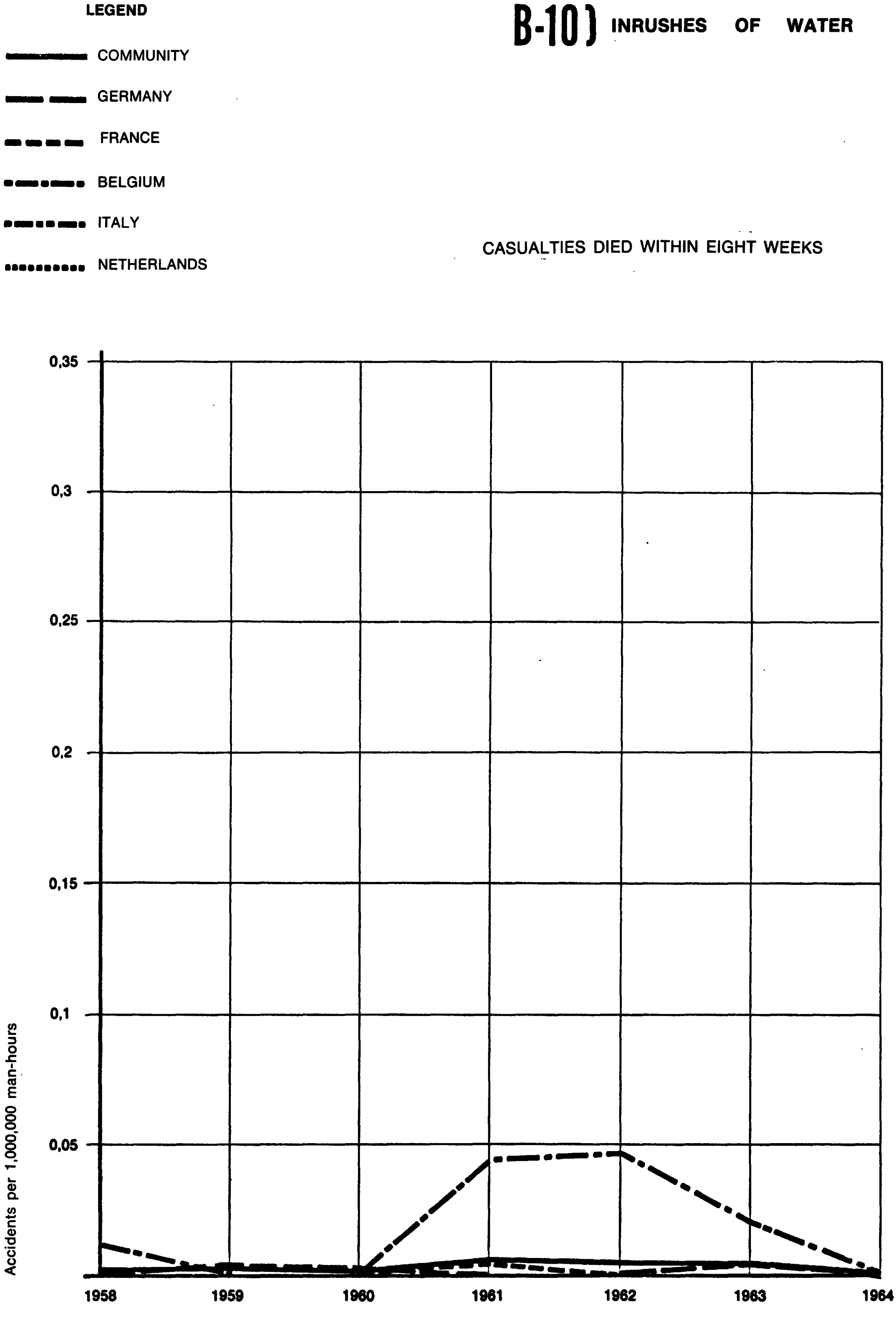


B-9) UNDERGROUND COMBUSTION AND FIRES

No graph is given, the number of values available being too small

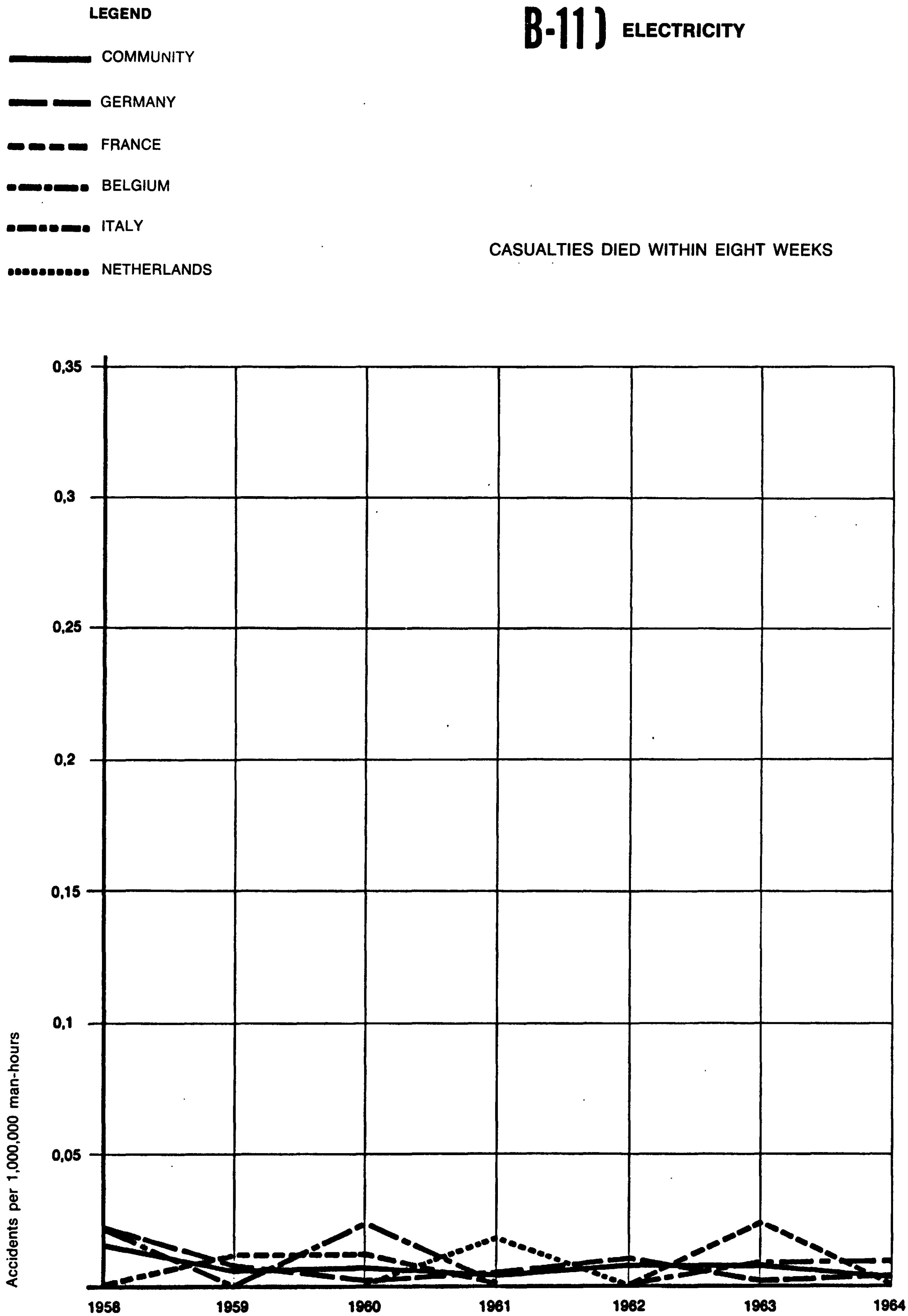
B-10) INRUSHES OF WATER

CASUALTIES DIED WITHIN EIGHT WEEKS

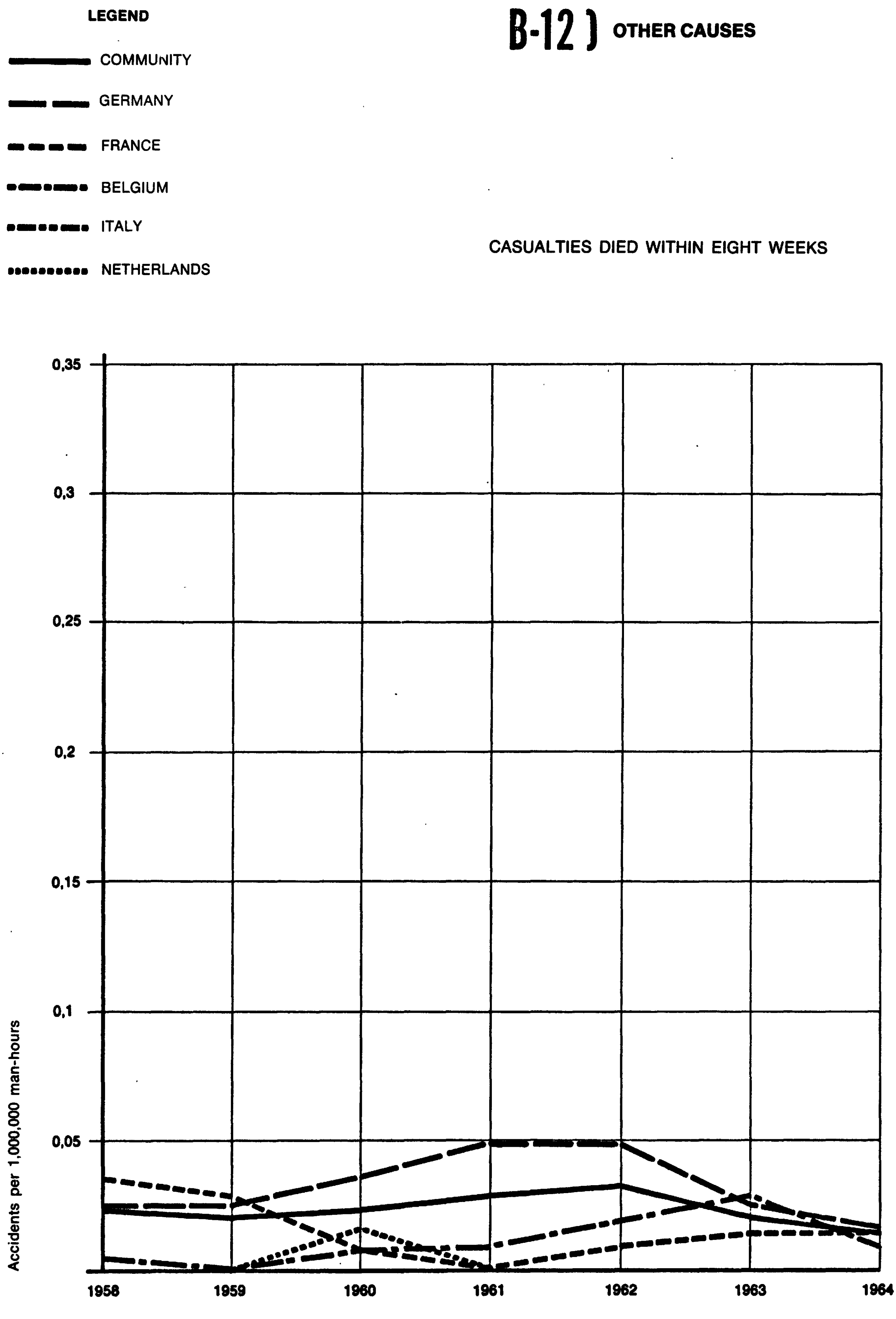


B-11) ELECTRICITY

CASUALTIES DIED WITHIN EIGHT WEEKS



B-12) OTHER CAUSES



A N N E X E S

TO THE THIRD REPORT

OF THE MINES SAFETY COMMISSION

ANNEX I

R E P O R T

on trials with explosion-proof dams, carried out by the Experimental Roadway Association of Dortmund at the request of the Mines Safety Commission and with the financial aid of the High Authority. Statement of policy regarding the erection of advance dams of plaster as a fire-fighting measure.

(Approved by the Mines Safety Commission at its Plenary Session of 28.4.64)

I. After an accident due to firedamp involving a number of workers, the Mines Safety Commission at their plenary session of the 7th July 1959 invited the Working Parties on Mine Fires and Rescue Organization

- to examine the question of the erection of stoppings in combating mine fires and to present suitable proposals on this subject.

After the Working Parties had given very careful attention to the question and had increased their knowledge by two experimental explosions in the TREMONIA mine, owned by the Versuchsgrubengesellschaft m.b.H. Dortmund, they presented to the Safety Commission a report including Recommendations on the use of stoppings for isolating areas affected by mine fires; this was approved by the Plenary Session held on the 20th of December 1960.

At the Plenary Session held on the 8th of April 1960, the Mines Safety Commission unanimously agreed that the problem had not been solved by the drawing up of these Recommendations, which consisted essentially of directives for designing and erecting temporary stoppings, and carrying out preparatory work involved.

They came to the conclusion that a large number of experimental explosions would be necessary before any conclusions of practical value could be drawn about the resistance of any particular materials or method of erecting the temporary stoppings.

They therefore agreed that the tests should be carried out by the Versuchsgrubengesellschaft m.b.H. Dortmund, and that a request for financial aid for this purpose should be made to the High Authority.

- The Versuchsgrubengesellschaft finished the experimental explosions and presented their final report which appears as an Annex to this present note, which also contains the interim reports.
- The Working Parties examined this report in the presence of the head of the research project and expressed their agreement with the conclusions which had been drawn.

Although no data are yet available on the behaviour of plaster stoppings subjected to a severe explosion occurring in actual mining conditions, the Working Parties considered that, on the basis of the experimental results, they could present the following report.

II. Report regarding the erection of plaster stoppings for combating mine fires

- In view of the information obtained from the carrying out of a test programme on explosion proof fire stoppings,
- In view of the experience acquired up to the present in erecting these stoppings underground after these tests had been carried out,

the Working Parties recommend, as stoppings for sealing off mine fires, that plaster stoppings should be erected whenever it is possible and advantageous to do so.

In all the conditions in which the tests were carried out, the plaster stoppings showed themselves superior to the sand-bag stoppings which have hitherto been used, on condition that certain rules are observed when they are erected.

Plaster stoppings have the following advantages over sand-bag stoppings:

- increased safety for the teams erecting them. Apart from a group of observers of approximately two men, the teams can remain up to 300 metres away from the stopping and, when circumstances permit, even in the fresh airstream,
- greater strength,
- a reduction in the time required for building them by the adoption of a method which is largely automated.

On the basis of the tests already carried out and the experience gained up to the present, the rules to be observed when constructing plaster stoppings may be summarised as follows:

1. SUPPLIES

1.1 Materials

1.11 There are only limited possibilities for stocking plaster. For this reason it is not recommended that a reserve should be held. It is advisable to obtain information about the possibilities of delivery and to make a contract ensuring immediate delivery in case of emergency.

Similarly it must be ensured that loading of the plaster at the shaft and transport towards the place from which it is to be blown can be carried out without difficulty.

It is recommended that a "supply line" should be set up and that this should be maintained until the stopping is finished.

1.12 Materials for building the stopping

Timbers and facing boards or planks are required for the walls of the stopping. This material is generally available in the mines. Matting consisting of silicate fibres on wire netting are needed for lining these walls of planks. Where necessary, brattice cloths or tarred felting can be used.

1.2 Apparatus

1.21 Air reservoirs

For blowing the plaster, any type of air reservoir suitable for blowing dust-form products can be used. For the sake of efficiency, at least two reservoirs of the same type should be provided for each stopping.

1.22 Blowing pipes - there must be an adequate number available. According to the cross-section, 4 to 6 pipes are required for each stopping; the length of one of these pipes must be at least equal to two-thirds of the thickness of the stopping. It is sufficient if the others are 0.8 to 1 metre long. The head of the blowing pipe must be constructed in accordance with the diagram in Fig. I. At the back end, the pipes must be provided with sufficient joints so that hoses may be attached (usually hoses type C, i.e. quick-connecting fire hoses 52 mm. in diameter) which are generally used for dust-form products and water. Care must be taken to ensure that the annular connection for the addition of water is fixed to the pipe ejecting the plaster powder so that it cannot slip, otherwise the plaster will not be wet enough. In theory it is possible to recover the blowing pipes, so that they may be used again when erecting other stoppings. However, in dangerous situations, recovery is somewhat uncertain. Consequently the pipes required for each stopping must be available, or it must be possible to prepare them rapidly.

1.23 Lances for additional water at the crown must be made from pipes with connections as shown in Fig. 2. The lances, whose basic length is 1.5 metre, must be provided with extension pieces until the total length is equal to the full thickness of the stopping. The water lances can, in any case, be recovered, so that it is sufficient if there is one lance for each site on which a stopping is erected.

1.24 Water-flow meter (flow approximately 100 litres/min) and distributor with 3 to 5 branch pipes each equipped with a tap.

1.25 Hoses. An adequate number of hoses for the water, plaster and compressed air must be prepared. At least a double line of type C hoses (fire hoses 52 mm in diameter) must be laid from the site of the stopping up to the receivers. Moreover, the water must be taken right up to the site of the stopping, where it must be distributed between the various plaster pipes. In order that at each point branch pipes may be fitted to the existing air and water pipes, a device should be provided to pierce the pipes, and the necessary valves should be available.

1.26 The snuffle pipes and, where necessary, stopping pipes with covers (for a man to pass through) and other materials to be incorporated in the stoppings must be prepared.

2. PREPARATIONS

2.1 At the site of the stopping

2.11 The seals (sealing walls) must be erected as far as possible perpendicular to the axis of the roadway and over its whole section.

When the height at the roadway crown is 3 metres at the site of the stopping, the distance between the walls of the stopping must be at least 2 meters; when the height is 3.5 metres the minimum distance must be 2.5 meters. Where the crown is higher, the interval should be equal to this height. (These are empirical values which may be adopted directly for roadways with a small cross-section. Practical tests in roadways with a large cross-section are envisaged to correct or confirm these values.)

Before the walls are erected, the stopping pipe as well as the other elements to be incorporated in the stopping (snuffle pipe, etc.) must be put in place. The pipe must be placed in the lower part of the roadway, if possible at a maximum height of 70 cm. above the level of the roadway floor.

When erecting the walls of the stopping, timber props are first set and half-round timbers or planks are fixed to them on the inside. These are nailed so that the interval between them is equal to the plank width, but in any case must not exceed 15 cm.

The lining is also nailed onto the interior face of the stopping. For the fire side of the stopping, which is later to be coated by means of a jet of plaster, it is essential to use mats made of silicate fibres reinforced by wire netting. On the other side, brattice cloth or roof felt will suffice. Care must be taken to ensure that the stopping fits tightly at the walls and floor of the roadway. An opening must be left for the men working between the walls of the stopping so that it can be closed from the outside.

2.12 When, during fire-fighting operation underground, a stopping is being erected rapidly in order to prevent any risk of explosion or rapid propagation of the fire, it is not generally necessary to key the walls or roof.

If sufficient time is available it is advisable to improve the tightness and the anchoring of the stopping by keying the walls and, if possible, the roof at the site of the stopping, at least on one side. It may even be useful to make an artificial dome in the roadway roof so as to ensure better wetting and good adhesion of the plaster mass to the roof.

In roadways supported by brick walling or smooth concrete blocks, holes must be drilled in the strata; bars are fixed in these holes (e.g. old mine-car axles) to anchor the stopping.

2.13 The blowing pipes must be distributed over the whole section of the roadway. When the floor is less than 4 metres wide, two pipes at a height of 1.5 metres are sufficient in the right- and left-hand halves of the roadway. Two or three pipes are also required under the roof. One of these pipes must be shaped and arranged so that it reaches the highest point of the crown (after lagging has been removed) or penetrates the artificial dome, in order to allow the plaster to be blown right under the crown. Except for this pipe, which is the last one from which plaster is blown, all the pipes must be arranged horizontally to prevent penetration of the liquid plaster, which could easily cause obstruction. On the other hand, it is recommended that they should be slightly turned towards the walls.

In order to prevent any movement during the blowing, the pipes must be solidly anchored. However, care must be taken to ensure that this anchoring can be removed from the outside so that the pipes can be taken out when they are no longer needed.

2.14 The water-flow meter and distributor are attached to the existing water pipes or to the new ones, so that the meter measures the total flow. For a water consumption of 100 meters per minute the pressure in the water pipe must not exceed 3 atm. gauge.

The various blowing pipes are attached to the distributor, one of the branch pipes at least being reserved for the lance. If there are not sufficient branch pipes to serve all the blowing pipes, they must be disconnected and reconnected during blowing operations, when the lower pipes are no longer being used.

2.2 The site of the air reservoir

2.21 Reservoir. As favourable a site as possible must be selected. Previous experience has shown that with the equipment at present used (e.g. Rheinelbe and Haarmann reservoirs) it is possible, with a compressed-air pressure of 4.5 atm. gauge to blow through a 300-metre pipe; the difference in level may be as much as 100 metres.

The receiver will, as far as possible, be placed in the fresh-air stream and, in any case, in a protected place so that the teams are not directly exposed to the shock wave in the event of an explosion. Provision must be made for transporting the plaster (approximately 20 - 50 tons will be required, according to the cross-section of the roadway). It is advisable to provide points, or at least a siding, for the empty mine-cars.

2.22 The number of compressed-air branch pipes should be determined by the numbers of reservoirs used.

2.23 The unrolling of the hoses from the reservoirs to the stopping is done during the last stage of preparation. Care must be taken to protect the hoses, as far as possible, from damage.

3. BLOWING ON THE PLASTER

3.1 The plaster

3.11 It is advisable to blow regularly, preferably with several pipes - at least two - so that there is always one blowing pipe in use at the stopping. The rules for the selected type of air reservoir must be followed.

3.12 Previous experience has shown that it is advisable to blow first of all with the lower row of pipes. When these are obstructed by the mass of plaster accumulating at their mouths, the upper row is then used. The pipes which have become blocked up must be withdrawn from the stopping as quickly as possible because, after a certain time, it is no longer possible to do so.

3.13 Finally, the plaster is blown through the longer pipe, which reaches the highest point in the thickness of the stopping, and which blows into the roof until the stopping will absorb no more plaster.

3.14 The obstructions in the hoses must be eliminated quickly, where necessary by a replacement of the sections which have become clogged. It is advisable to have reserve hoses.

3.15 Interruptions in blowing are to be avoided as far as possible, but if work has to be interrupted for only a few hours a sufficiently firm stopping can still be achieved.

3.2 Water

3.21 The flow of water is regulated at the site of the stopping. Care must be taken to cut off the water supply to pipes which are not in use.

In order to prevent frequent connecting and disconnecting of the water pipes, it is advisable to connect as many blowing pipes as possible to the water distributor.

The supply of water must be regulated so that there is a flow of 50 litres of water during the time required to blow 100 kg of plaster. The water must be cut off when the blowing is interrupted, so as to prevent excess water from forming channels along which wet plaster could flow during subsequent blowing.

The total quantity of water delivered must be checked from time to time by means of a meter (the meter reading should be noted at the start of the blowing operations!) so that it can be compared with the quantity of plaster blown during the same period. 500 litres of water per ton of plaster should be aimed at. Any shortage of water can to some extent be compensated for by increasing the flow later.

3.22 The water lance is used towards the end of the blowing process. It is used for injecting water at all points where the stopping is not sufficiently firm and where it is still possible to introduce the lance. This will be particularly in the roof, but more water may also be needed near the walls. The flow of water through the lance is regulated so as to prevent a large stream of water flowing from the stopping. When the flow escaping is excessive, a new hole must be drilled. The water must be injected both into the front part (by means of an extended lance) and into the back part of the stopping.

3.3 Protection against dust

During blowing, the men working at the receiver and those close to the stopping are bound, in certain conditions, to be exposed to considerable dust nuisance. This applies particularly if the stopping is erected in the return airway of a district affected by fire. For this reason it is recommended that the teams working on the blowing as well as the men near the stopping itself should always be equipped with dust masks and goggles, unless they are wearing protective apparatus against gas owing to the high carbon monoxide content.

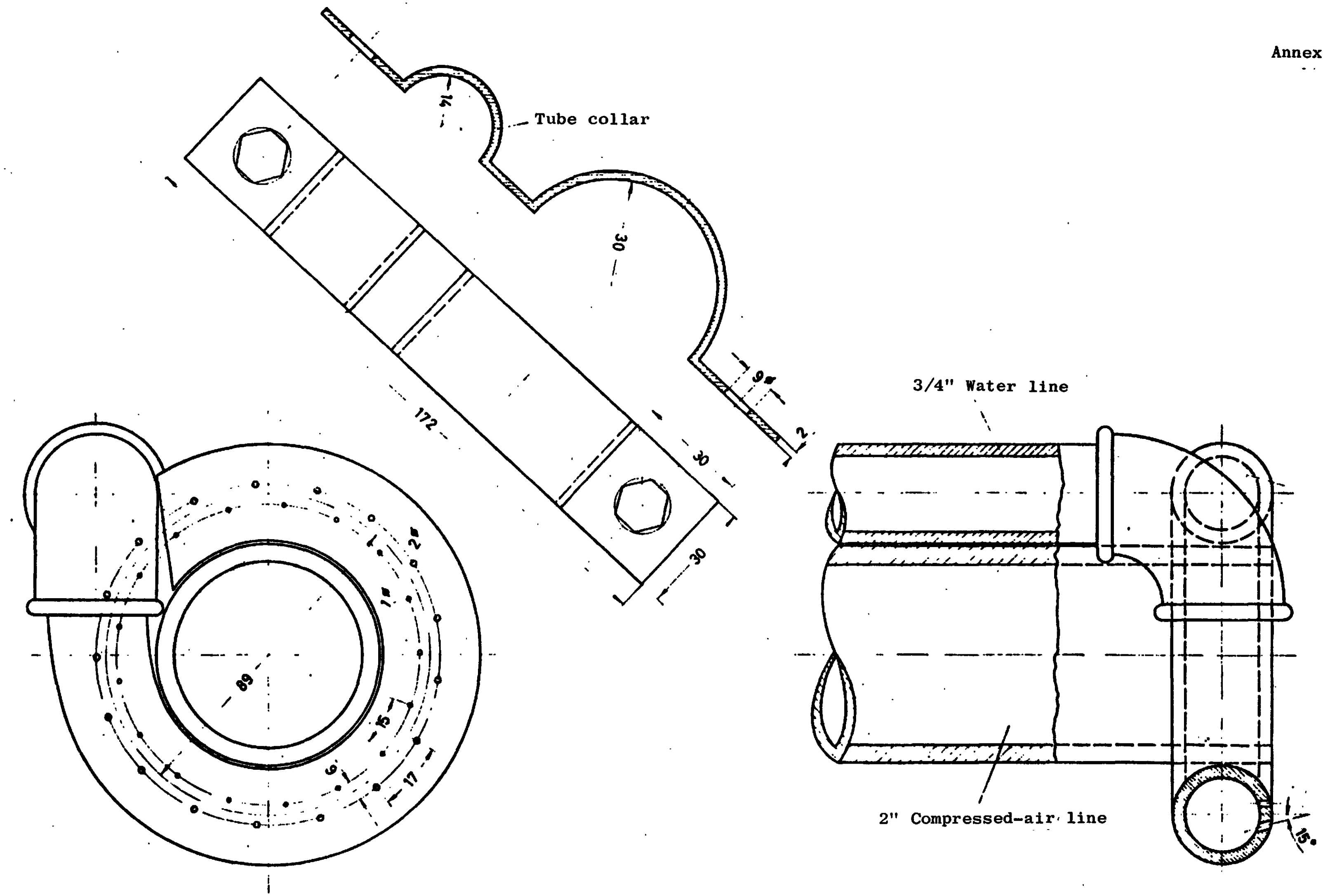
4. FINAL OPERATIONS

It is not necessary to reinforce the stopping by strutting. If the stopping itself is not sufficiently airtight it must be reinforced by the usual methods, e.g. the introduction under pressure of cement and stone-dust grout in the space between the stopping and a wall which should be erected a short distance from the stopping.

x

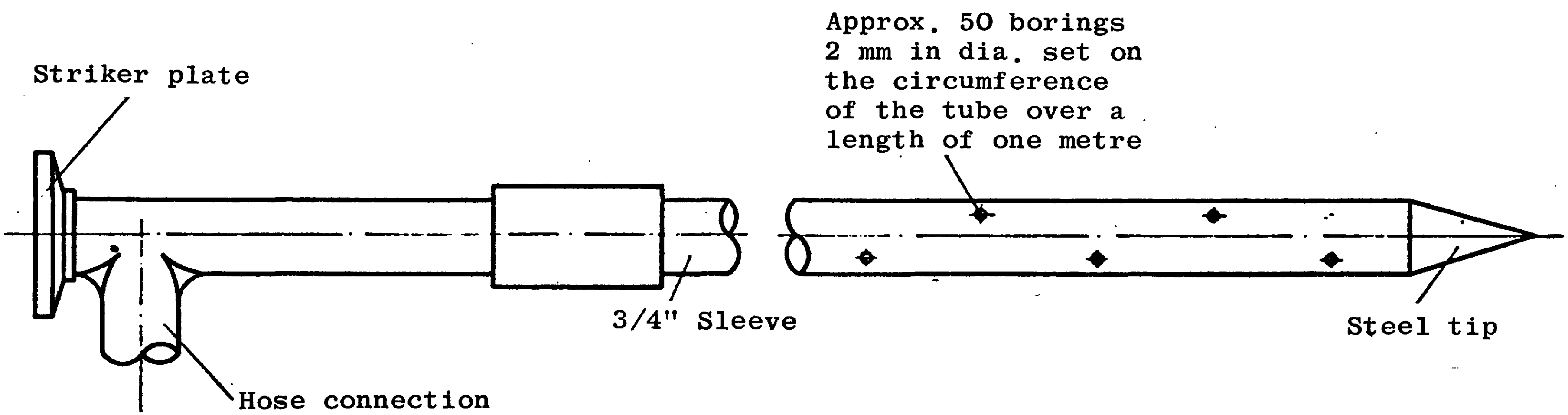
x x

Annex I (d)


Tube collar
14
30
9
2
172
30
30
89
1
2
1
15
6
17
3/4" Water line
2" Compressed-air line
15°

Annex I (e)

Water lance



ANNEX II

R E P O R T

on the opening-up of sealed-off fire areas, and rules applicable thereto.

(Approved by the Mines Safety Commission at its Plenary Session of 16.10.64)

Following acceptance, at its Plenary Session of December 20, 1960, of Recommendations on the sealing-off of fires and seats of underground combustion, the Mines Safety Commission decided to investigate further unresolved problems associated with this question.

It instructed the Working Parties on Fires and Underground Combustion and on Rescue Organization to study

- the problem of the resistance of a particular material and a particular method of construction of the stoppings to be erected, and
- the problem of reopening sealed-off fire areas.

Investigation of the first problem was concluded with the submission of a report and opinion to the Plenary Session of the Commission of April 28, 1964.

The problem of the reopening of sealed-off fire areas was first discussed by the Working Parties at their joint meeting of December 7, 1961. After the Delegations of the Community countries and of the United Kingdom had supplied sufficient documentation on the methods adopted in their countries for reopening sealed-off fire areas, this material was subjected to a first examination at the meeting of April 13, 1962. It was decided to entrust the analysis of the documentation to an expert. On the basis of this documentation and of an additional study of relevant source material from countries other than the member countries of the Community and the United Kingdom, this expert drew up a conspectus offering a clear and detailed comparison of the various methods employed.

On the basis of this study, a sub-committee set up by the Working Parties drafted (Doc. No. 2253/63) proposals which, following detailed examination, the working parties now submit to the Commission in the form of general rules, which can provide those responsible for the reopening of sealed-off districts with useful information on the method to be adopted.

GUIDING PRINCIPLES
FOR THE REOPENING OF SEALED-OFF FIRE AREAS

I. GENERAL

Special reasons for reopening a district sealed off after a fire:

Recovery of bodies

Salvage of material

Recovery of roadways and workings

Reduction of the sealed-off area

Inspection of the district

and, even, where necessary

direct fire-fighting.

The following hazards can arise from reopening a sealed-off district:

Release of CO, foul air and hot damp air

Explosion of fire-damp or fire gas, where the fire is not yet extinct

Recrudescence of the fire.

Recrudescence of a fire does not always take place at once, but is possible even after a considerable delay. This is, however, more likely in the case of an endogenous fire than with one ignited by external causes, and more especially as a consequence of insufficient cooling-off of the fire areas. Recrudescence of the fire can occur only when fresh air reaches the seat of the fire, so that with all operations involved in reopening a fire area it is of prime importance to inspect the individual air currents constantly; in addition, all places suspected of having been seats of fire or heatings must be ascertained with the utmost speed.

By its very nature, the reopening of a district sealed-off on account of underground combustion or an open fire always constitutes a risk. Each case must be considered individually; in view of the numerous factors of uncertainty, it is impossible to guarantee success even if these rules are followed; the failure of a reopening operation is not necessarily an indication that the wrong method was chosen, but may be a consequence of the action of imponderables which could not have been foreseen before operations began.

II. FUNDAMENTAL RULES

According to the regulations in force in the individual member countries, sealed off districts may be reopened only after the competent authorities have been notified or have given their permission.

Before opening commences, gas samples must be taken from the fire area, at each stopping and from all snuffle pipes; the gas samples are then analysed and the results assessed from the point of view of explosion risk and the state of the seat of the fire.

In addition, the cooling-off time of the seat of the fire must be taken into account.

If possible, the sealed-off district should be inspected before any air is circulated or any operations are started. Details of the method to be adopted depend on the risks to be expected, e.g. the risk of the fire recrudescing and causing an explosion of firedamp or fire gas (fumes).

Before opening commences, a plan should be drawn up jointly with the Rescue Centre.

This plan must cover the following points:

the method to be adopted,

nature, scope and order of operations,

direction and supervision,

checking of the ventilation system and of the composition of the air,

communications,

preparation of material,

evacuation, prohibition of access to and remanning of endangered workings,

inspection by the Rescue Team,

connection and disconnection of electrical equipment and isolation from the supply of electricity,

opening and closing of the compressed-air, water and methane-drainage pipeline valves,

re-sealing of the fire area in emergency.

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The method to be adopted for reopening sealed-off districts depends on the presence or otherwise of

non-explosive mixtures of gas which remain non-explosive on dilution with air,

mixtures of gas which may become explosive on dilution with air, or

explosive mixtures of gas.

Fire areas may be opened at one point only or at several points. In the later case a continuous direct circulation of air is established and the fire area is permeated with fresh air. An examination should be made of the effects of the opening of the area on the ventilation system of the pit as a whole and within the fire area.

A sealed-off district can be reopened by

breaching one or more stoppings (with or without the use of an air-lock), or

cutting a new entry into the fire area.

Before opening a sealed-off area, provision should be made for immediate reclosure if necessary.

Stoppings may be opened only on the instructions of the manager and under the constant supervision of personnel appointed by him.

Workings, into which the opening of a stopping may release toxic gases or foul air, or where there is a risk of explosion, must be evacuated and put out of bounds to personnel before opening.

Since conditions in the district, the state of the seat of the fire and the risk of gas explosion may change during the opening operation, the composition of the fire gases or fumes must be checked at regular intervals. The kind and number of samples and the points at which they are to be taken should be fixed in advance. In doing so, the possibility of gas accumulations (1) forming should be allowed for.

Where a stopping is opened in the knowledge that the fire is not yet extinguished, or where the fire is revived as a result, the area in question must be resealed at once if the composition of the fire gases or fumes changes in such a way that an explosion hazard might arise. With non-explosive gas mixtures in the fire area, this is necessary only if extinguishing operations seem unlikely to succeed.

It is the responsibility of the Rescue Team to open and inspect fire areas, even after they have been ventilated.

On the intake side, breaching of stoppings need not be carried out by the Rescue Team provided that no gas hazard is to be reckoned with.

When calling in the Rescue Team, allowance should be made for the adverse climatic conditions which are likely to obtain at any point where they may be employed.

III. OPENING OF SEALED-OFF DISTRICTS CONTAINING NON-EXPLOSIVE GAS MIXTURES

1. Opening on one side only

A sealed-off district containing non-explosive gas mixtures may be opened on one side even if the fire is not yet extinguished.

It must first be established whether the remaining stoppings and seals are sufficiently airtight and that there is no risk of releasing fire gases, in particular carbon monoxide, in other parts of the working, which may be connected with the fire area. If the stopping to be opened is on the return side, special attention should be paid to the release of CO or of foul air.

The decision as to whether to carry out the operations in the fire area without ventilation air or with auxiliary ventilation depends on the purpose of the reopening of the area, the expected duration of the Rescue Team's operations and the possible hazards involved. Auxiliary ventilation is especially desirable for extended operations within the fire area.

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(1) In general, the formation of gas accumulations is favoured by low air velocities and differences in temperature.

a) Working without ventilation air, especially behind an airlock, has the advantage of eliminating the risk of reviving the fire (1).

b) If auxiliary ventilation is used, it should preferably be by suction. It is advisable to isolate the area ventilated by an auxiliary fan from the non-ventilated section by means of an auxiliary stopping if the seat of the fire is situated in the non-ventilated section.

2. Opening on two sides to establish a circulation of air round the fire area

A fire area containing non-explosive gas mixtures may be ventilated only if it is likely that the fire is extinct.

As soon as ventilation is established, a Rescue Team wearing breathing apparatus may enter the fire area to examine conditions within it and to extinguish any fires.

IV. REOPENING OF SEALED-OFF DISTRICTS CONTAINING GAS MIXTURES WHICH MAY BECOME EXPLOSIVE ON DILUTION WITH AIR

1. Opening on one side only

A fire area containing gas mixtures which may become explosive on dilution with air may be opened on one side even if the fire is not yet extinguished. It is, however, essential to install a tight airlock in front of the stopping to be opened, so as to ensure an effective air seal.

It must first be checked whether the remaining stoppings and seals are sufficiently airtight and that there is no risk of releasing fire gases, in particular carbon monoxide, into other parts of the workings which may be connected with the fire area. If the stopping to be opened is on the return side, particular attention must be paid to the possibility of releasing CO, CH_4 or foul air. All operations must be carried out without ventilation air. There must be continuous sampling and evaluation of the results of analysis to check whether the gas mixture remains non-explosive. For extinguishing operations, see footnote (1) on this page.

If the size of the sealed-off area is to be reduced, a new explosion-proof stopping must be erected. In order to be able to erect this stopping under tolerable climatic conditions and possibly without wearing breathing apparatus, auxiliary ventilation may be provided.

For this purpose, an auxiliary stopping must first be erected and sealed in inert atmosphere (2). The section of roadway thus recovered must then be ventilated by an auxiliary fan so as to create a suitable climate for the erection of the main stopping.

When starting up the auxiliary ventilation it must be remembered that the gas mixture becomes explosive on dilution with air. It is therefore essential to make certain beforehand that there are no sources of ignition (e.g. heatings on fires) in the workings to be ventilated. To prevent any risk of ignition by the auxiliary fan, the latter should be of the forcing type.

Before starting up the auxiliary ventilation, all workings likely to be exposed to the hazards of fire gases or explosions must first be evacuated and access thereto prohibited. Electrical equipment must be cut off from the power supply. In addition, the ventilation must be regulated, so that no explosive gas mixtures can be released over long distances. For this purpose, the quantity of air circulated should, if necessary, be increased.

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(1) When carrying out extinguishing operations without ventilation air and under unfavourable climatic conditions, it is advisable first to set up water sprinklers and to put these into operation only after the Rescue Team has left the fire area.

(2) Before constructing the main stopping, it should be considered whether to erect several successive auxiliary stoppings, according to the possible hazards.

2. Opening on two sides to establish a circulation of air round the fire area

This method of opening automatically results in the formation of a through air-circuit in the open district, but not necessarily in all air-circuits in the fire area. The method can be used only if there are no remaining signs of fire in the district. In addition, a period long enough for the seat of the fire to cool off must have elapsed since the supposed time of extinction. If possible, the Rescue Team should carry out an inspection in inert atmosphere. Failing this, the results of the snuffle-pipe tests should be used to determine the condition of the seat of the fire. Furthermore, it should be considered in such cases whether the method described in Section IV.1 might not be preferable.

In each case, it is essential to check the likelihood of a recrudescence of the fire during ventilation, by means of fire-gas samples. This is particularly important where a fire area has a much-branched ventilation system.

Before ventilating the fire area, all workings exposed to the hazards of fire gases or explosions of fire gases or firedamp when the stopping is opened must be evacuated. All electrical installations in these workings must be cut off from the power supply.

On safety grounds, it is advisable to open the return stopping first. After the Rescue Team has withdrawn to less dangerous zones, the intake stopping should be opened.

When ventilating the firm area, the quantity of air and the content of inflammable gases in the air-current circulating round the fire area, and in the current into which it subsequently flows, should be checked. The two air currents should be mutually adjusted in such a manner as to ensure that no explosive mixture of gases is present over long distances after their junction.

Access to the fire area during ventilation is prohibited.

V. OPENING OF FIRE AREAS CONTAINING EXPLOSIVE GAS MIXTURES

Sealed-off districts may not be reopened, either on one side or on two sides, if the presence of explosive gas mixtures behind the stoppings is established.

VI. OPENING OF FLOODED FIRE AREAS

The composition of the air in fire areas flooded to extinguish the fire must be checked after draining.

In workings with solid coal, allowance must be made for the increased hazard of spontaneous ignition after drainage.

Where fire areas have been isolated by local flooding instead of by stoppings, the rules mentioned in Sections I to V should be observed insofar as applicable.

VII. REMANNING OF FIRE AREAS

After ventilating a fire area, workings may not be manned until a Rescue Team has established that all workings are free of noxious gases.

If the fire area is merely being reduced in size, workings free of noxious gases may be manned only when the remainder of the fire-area has been sealed off by permanent stoppings.

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ANNEX III

R E C O M M E N D A T I O N

regarding the provision of advice from foreign experts in the case of major accidents.

(Approved by the Mines Safety Commission at its Plenary Session of 12.12.64)

Although there is close collaboration between the Directors of the Main Rescue Stations within the Working Party on "Co-ordination of Mine Rescue Organization", the Mines Safety Commission has concluded that it can be advantageous in certain cases to provide for the advice of experts specially qualified in mine-rescue operations from other countries (in the event of major accidents).

To this end it is recommended that the Directors of the Main Rescue Stations of the Community countries should have available a list showing:

- the location of the Main Mine Rescue Station,
- the names of the Directors and their deputies,
- the official and private addresses,
- telephone and telex numbers,
- regional colliery-location maps,
- a catalogue of closed-circuit and other apparatus.

This list should always be maintained up to date.

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Annex IV

R E P O R T

on the communication links between the rescue base and the rescue team.

(Approved by the Mines Safety Commission at its Plenary Session of 15.2.66)

A. The Working Party on "Mine Rescue Organisation" has been instructed by the Safety Commission to raise within the framework of the general discussions the problem of communication links between the rescue base and the rescue team, and if appropriate to suggest improvements; this instruction was prompted by a fatal accident which occurred in the Ruhr in 1962 during rescue activities.

Based on the then state of affairs in Belgium, Germany, France and the Netherlands - as established by a questionnaire - the following main points were listed as being in the members' view of particular importance to everyone responsible for rescue operations, closing with a few proposals for the improvement of the communications equipment.

B. All the experts involved in the discussion of this problem agreed that in the event of deployment of a rescue team:

- a rescue base is to be set up at a suitable point in the fresh air-stream, and that at this point there should be the person responsible for the rescue team being deployed and for supervision of the rescue base, together with the necessary apparatus, and that there should also be reserve teams nearby.
- there should be a two-way communication link between this base and the head of the rescue operation and
- a two-way communication link between this base and the rescue team in action.

I. Communications link between the rescue base and the head of the rescue operation

The general view was that for this link the only possible means was telephone communication by a connection from the rescue base to the colliery telephone network.

II. Communications link between the rescue base and the rescue team in operation

This communications link is basically considered as being necessary, and at all events desirable.

It is undoubtedly necessary:

- for reconnaissance
- for all activities under difficult conditions (increased temperature, falls of roof, etc.).

It is desirable for all stationary operations which are carried out under normal climatic conditions and in places which have been reconnoitred.

Two types of communication link can be used:

- communication by acoustic signals and
- telephone communication.

Up to the present, other systems such as radio-telephone and other means have not been found to be usable.

1. Acoustic signalling

In acoustic signalling a distinction is made between

a) tapping signals on sound-conducting substances (e.g. pipes) and

b) electro-acoustic signals, produced by means of a source of electric current and a conductor.

With either system the transmission of information proceeds from one station at a time by means of a code. This code must be simple (easy to understand and remember) and so composed that the risk of confusion between signals is reduced to a minimum.

This system is particularly unsuitable for important reconnaissance or for deployment of rescue teams under difficult conditions.

It can however provide good service if no other means are avalaible or if the telephone links are bad or damaged.

2. Telephone communication

When mouthpieces are in use telephoning is forbidden. Up to the present it has only been possible to telephone easily and clearly when using a mask. All the telephone equipment used at the present is either intrinsically safe or explosion-proof.

In certain countries it is planned to use transistor amplifiers and loudspeakers at the rescue base.

It is emphasised that there is unanimity among the countries in using two-wire telephone leads. In no case would a single-wire telephone lead be used together with the earth-return lead.

Two different systems are in use for telephone communication:

a) Telephone system without continuous listening/speech link provided with calling-up facility

The telephones at the rescue base and with the rescue team in action both have a calling-up device. This can be carried on the body or laid down or suspended near the working point. This system is used in France and in the Saar for all rescue operations, while in Belgium, in the Ruhr and in the Netherlands it is used only for stationary activity.

All mine-rescue personnel who telephone must wear a mask, and this must be a simple mask or a mask with a "speech disc". The view tends to be that speech discs are no longer necessary with the new types of mask. The transmission of speech is sufficiently comprehensible and the risk of a leak through the speech disc is eliminated. The telephone devices remain switched on.

When the telephone cable is being laid or the rescue team is changing position, the telephone apparatus is carried either on the men's belt or in a carrying case.

In the Ruhr, the Saar and in Belgium it is possible for third persons who are wearing masks and carrying a telephone to use the telephone lead from any point by means of a pricker connection or a special device. This problem is still being investigated in France.

Telephone communication can be carried out over distances between 1000 and 10,000 metres according to the type of telephone used.

The telephone lead is wound on drums and provided with plug connections; in favourable circumstances it can be recovered.

Special practice cables are used in training.

b) Telephone system with continuous listening/speech connection and without calling-up facility

The telephone equipment at the rescue base consists of a headset which is worn during the whole period of activity and a microphone. The telephone equipment for the rescue team consists also of the headset, worn by the leader of the team over one ear, and a microphone built in to his breathing mask. This system is always used in the Ruhr, in Belgium and in the Netherlands when reconnoitring or during particularly difficult work.

With this system the two users are in continuous listening/speech communication; no calling-up device is necessary. Should the team leader - who is wearing the mask with the microphone - feel unwell, the apparatus used in the Ruhr and in Belgium makes it possible for any other member of the rescue team wearing a normal mask to make contact with the rescue base by using the headset as microphone and speaker.

As with the system referred to above, it is possible for third persons who have a mask with telephone fitments to connect themselves at any point to the telephone lead by means of a pricker. A link can be achieved over more than 2,000 metres.

The very thin telephone lead is housed in a container like a preserving tin carried on the team leader's belt. The wire unwinds automatically as the man carrying its advances. It cannot be recovered; the light-blue colour of the wire used in the Ruhr and the Saar makes it easier to see in the smokefilled atmosphere than the wire used in Belgium.

Special drums are used during practice, attached to the lid of the closed-circuit oxygen apparatus. In this instance the telephone cable is recovered.

III. Special experience

a) The telephone system using the continuous listening/speech connection has been used for more than ten years in the Ruhr and has proved its value.

   It has the disadvantage from the economic point of view that the telephone cable cannot be recovered.

b) In Lorraine there is the possibility of connecting the rescue team's telephone lines to the colliery telephone system. This method, which has been repeatedly used, is very satisfactory in use and provides direct speech communication between the advancing rescue team and the head of the rescue operation at the surface.

IV. Instructions, regulations and principles for transmission of information

In Belgium and in the Netherlands there is no Inspectorate regulation for transmission of information. In France the situation is covered by internal instructions. In the Ruhr and in the Saar the regulations issued by the Chief Mines Inspectorate in Dortmund or in Saarbrücken apply.

Where there are regulations, they all call for a communications link between the rescue base and the rescue team in action.

V. Summary

In all the Community countries the problem of a link between the rescue base and the rescue team in action has been faced and dealt with independently of Inspectorate regulations.

The measures adopted are similar in essence.

The telephone link is considered by all experts as the best means available at present.

In France and in the Saar, the telephone system without continuous listening/speech connection is employed in all rescue operations, whether these involve stationary work or reconnaissance.

In the Ruhr, in Belgium and in the Netherlands this system is used only for stationary work. For reconnaissance operations or work in particular difficult conditions the positive continuous listening/speech connection without calling-up facility is preferred.

The positive continuous listening/speech connection was selected by the countries named above for work involving particular risks once they had available a telephone apparatus that was sufficiently reliable in operation. In those countries the experts held the view that this system gives greater reliability, in spite of the burden of continuous "listening-out" both at the rescue base and by the rescue team in action.

In the same countries, the same system was not chosen for stationary work, to ensure that the team leader was not distracted during his work and to give the responsible official at the rescue base more freedom.

VI. Proposals for improvement of telephone apparatus

In very general terms, we have available today telephone equipment which is suited to the requirements of mine-rescue operations and which is sufficiently reliable.

Nevertheless, it remains true that rescue operations are always difficult and dangerous and that every effort should be made to ease this work and to make it safer.

The following proposals for the improvement of telephone devices are put forward:

1. Masks

   Since only breathing masks allow of telephoning, efforts should be made to improve them with regard to the following characteristics:

   Air-tightness, field of view, weight, method of attachment.

2. Tapping the telephone lead

   Pricker devices already available for thin telephone lines. It would be beneficial to have other tapping devices developed for other types of cable.

3. Weight and bulk of the apparatus, the cable drums, the cables, etc.

   should be adapted to the conditions of rescue operations.

4. Amplifiers

   Small, lightweight flameproof amplifiers should be developed, to ensure better comprehension where the communications link is faulty.

5. Radiotelephone connection

   Development of an effective radio-telephone system.

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ANNEX V

R E P O R T

on the use of accelerometers for testing winding installations.

(Approved by the Mines Safety Commission at its Plenary Session of 12.12.1961)

In its Report of March 1957 the Conference on Safety in Mines made the following Recommendation:

"32.M: The development of devices for testing shaft guides should be aimed at producing apparatus which can be easily handled by the personnel examining the shafts.

This recommendation was intended to encourage the perfecting of devices (particularly accelerometers) which can then also be entrusted to shaftmen not specially well versed in their use."
(Pages 148/149 of the Conference Report).

The Working Group on "Winding Ropes and Shaft Guides" was made responsible for the investigation of these problems by the Mines Safety Commission; the Working Party began with a general investigation of the use of accelerometers for testing the operation of winding installations.

The purpose of the present Report is:

- to bring together the information obtained regarding the various accelerometers used at the present time in the Community countries or being tried out there,

- to indicate the advantages offered by the use of such devices,

- to give conclusions from the present state of the part.

I. GENERAL

In its simplest form an accelerometer consists of a housing attached to the winding conveyance. This housing contains a mass which can move in a given direction with respect to the housing. This mass is balanced by springs, and its movements are damped by a fluid or by a suitable system of electro-magnets.

A recording device records a space/time diagram of these movements which are dependent on:

- changes in the speed of the conveyance in the direction being investigated,
- the inertia of the mass referred to,
- the characteristics of the compensating springs and the damping arrangement.

In this way information is obtained regarding the movements undergone by that part of the conveyance to which the accelerometer is attached in a given direction. Several directions of movement can be investigated by changing the setting position of the apparatus.

Moreover, the accelerometers in use generally have several measuring devices (two or three), with the masses arranged at right angles to each other; this allows of making simultaneous recordings of two or three principal directions:

- at right angles to the axis of the rope,
- horizontally in the plane of the guides,
- horizontal and at right angles to the plane of the guides.

II. DEVICES IN PRESENT USE IN THE COMMUNITY COUNTRIES OR UNDER TRIAL THERE

This covers the following devices:

- Cambridge accelerometer,
- Bochum Rope-Testing Station accelerometer,
- A.I.B. remote, trace and measuring device (Association des Industriels de Belgique),
- Novotechnik accelerometer, under trial in the Saar mines.

a) Cambridge accelerometer

This apparatus exists in various models: the most complete model is a double accelerometer which can measure the movements:

- either in one vertical or one horizontal direction,
- or in two directions at right angles to a horizontal plane.

The principal characteristics of this apparatus are as follows:

- recording on a cellulose acetate film by the pressure of ball-point pen,
- height of recording adjustable according to the natural frequency of the measuring devices:

  2 mm per gram for a natural frequency of 20 cycles/sec

  2 mm per 20 grams for a natural frequency of 70 cycles/sec.

  The damping of the vibratory mass is provided by an electromagnet ($D \cong 0,2$).

- Transport of the film by clockwork mechanism, which can run for a maximum of 7 to 8 minutes without being rewound (at the lowest speed of advance of the film). The speed of advance of the film is constant for a given diagram, but can be varied between 3 and 20 mm/sec.
- Possibility of recording time of some other signal by means of a third recorder.

  A special meter is used for the time signal, and this device is so adjusted that a time mark is made at regular intervals of 0.1 second with a longer mark for each complete second; this is done by breaking the exciter circuit of the recorder. The current is supplied by a separate battery.

- Reading-off the diagram by means of a magnifying glass or a microscope using a grid, or by photographic enlargement.

b) The Two-component Accelerometer of the Bochum Rope-Testing Station

The features of this apparatus are as follows:

- possibility (as with the Cambridge apparatus) of recording two movements simultaneously either in one vertical and one horizontal direction or in two directions at right angles to a horizontal plane,
- recording on waxed paper,
- paper transport by a clockwork mechanism, which can run for 9 to 10 minutes without being rewound.

  The speed of advance of the paper is constant at 10 mm/sec with an accuracy of $\pm$ 1%. Time markings are therefore not necessary.

- Height of recording. The undamped model has a natural frequency of 20 cycles/sec; damping is provided by a fluid of D = 0.6. A calibration curve for exciter frequencies between 0 and 20 cycle/sec has been prepared. As an indication we give the coordinates of some points on this curve below:

Frequency:	0	cycles/sec	- Excursion	5.1	mm/g
"	8	"	" "	5.2	mm/g
"	8	"	" "	5.6	mm/g
"	20	"	" "	3	mm/g

- Possibility of recording with a third pen which marks the excursion of a depth indicator every 10 metres. The depth meter consists of a rubber-tyred wheel set in a frame attached to the conveyance and bearing on the front face of the guide. The rotations of the wheel are transmitted to the pen via a flexible shaft.

- Possibility of recording each starting-up movement of the conveyance by means of a fourth pen operated by an undamped pendulum.
- Diagram can be read off by means of a magnifying glass with a grid, or by a linear scale or a slide rule. These diagrams are thus directly usable without photographic enlargements.
- The device works entirely mechanically and needs no electric supply.

c) <u>The remote, trace and measuring device of the A.I.B.</u>

The swinging mass of the device is made of ferrite, forming the core of a self-induction core inserted in a transistorised transmitter (one vibrator and two amplifiers). This transmitter sends out waves along the winding rope which transmit the movements so that they are indicated by means of a receiver installed in the winding-engine house. This frequency-modulated receiver transforms the frequency variations into voltage variations.

The device can be fitted with several vibrating masses so that recordings can be made either along the axis of the rope or in any direction vertical to the rope.

The A.I.B. says that the device is not sensitive to disturbance or to different variations (frequency modulation).

The height of indication is 19 mm/g.

If the receiver is set up near the machine, it is possible to record numerous other details: time marks, depth, switching operations, etc.

d) <u>The Novotechnik Accelerometer, at present under trial in the Saar</u>

This accelerometer supplied by the Novotechnik Company in Stuttgart was developed from a French device (S F I M device) and has the following features:

- Light-point recording on bands of silver bromide photographic paper,
- Advance of the chart by dc motor,
- Possibility of recording simultaneously:
    - 3 diagrams for three different directions,
    - 1 time mark per second,
    - depth indications every 10 metres (by means of a special depth indicator developed by the Saar Mines),
    - supply voltage 24 volts.

III. ADVANTAGES EXPECTED FROM THE USE OF ACCELEROMETERS TO CHECK THE OPERATION OF WINDING INSTALLATIONS

In actual fact an accelerometer records accelerations or decelerations accurately only if the frequency of the movements of its housing is nil or very slight. Where there are vibrations the mobile measuring device of the accelerometer tends to vibrate at its own natural frequency, and it is possible that the vibrations caused by several successive blows may coincide if they follow rapidly. The accelerometer then acts as a true impact indicator, which can give a rough indication of the blows on the basis of the amplitude of the vibrations or can distinguish between them by magnitude.

This being said, the advantages which may be expected from the use of accelerometers can be summarised as follows:

a) Use in vertical directions

In this direction the accelerometer and the entire winding conveyance are carried by one and the same movement. On the other hand, except with very rough shaft guides, the impacts will generally not be very heavy - the frequency of the movements will be zero or very low; consequently, the acceleration diagram will record accelerations or decelerations of the complete conveyance.

The proportionality of the forces to the accelerations can be used to deduce the changes of the entire system of dynamic loading at each moment of time, acting in vertical directions on the cross-section of the bearing rope attached to the conveyance (or over the total cross-sections of the bearing rope and the balance rope, if one is used).

This is important for the investigation of the (static + dynamic) total loading to which the ropes are subjected.

In addition, the variations in the vertical accelerations or decelerations during one wind can be used to show up the operating faults of the apparatus, particularly:

- any disturbances in an automatic winder,
- the operator's style of handling (for manually-operated machines),
- the functioning of the braking system.

A special case in which records of the vertical acceleration were useful and can still be useful exists when the loadings produced by the machine change with a certain degree of periodicity (where steam winders and some winch-type winders are used).

There may therefore occur at certain points on a wind a resonance between the frequency of these loadings and the vibration frequence of the entire system (conveyance + rope + machine + rope pulleys), which result in heavier dynamic loadings for the rope and, among other things, very heavy transverse oscillations.

The recording of the transverse acceleration makes it possible to establish the point on the wind at which resonance occurs and this can then be remedied by changing the speed or the masses of the entire system.

b) Utilisation in horizontal directions

In these directions the movements of the conveyance sometimes are of low frequency; the accelerometer will then record horizontal accelerations or decelerations which hold good for that point on the conveyance to which it is attached. It would be difficult to deduce the corresponding horizontal dynamic forces from this, since as a rule the type of movement will not be known.

It is, nevertheless, in these directions that the vibrations of the conveyance running in the shaft guides will occur most frequently. As explained above, the accelerometer then acts primarily as an impact indicator; it locates the irregularities of the shaft guides and determines their extent.

c) Layout of the diagrams

Using the diagrams obtained in the various vertical horizontal directions, the normal personnel responsible for shaft supervision can control the operation of the winding installation and the correct functioning of the shaft guides qualitatively.

As a general rule the diagrams of the horizontal directions are used for this purpose. If they are prepared at regular intervals of time, the state of the shaft guides can be watched and points where there is particular wear can be located.

There is no doubt that the accelerometer will find its principal use in routine checks on the equipment in this connection.

It must however be noted that its use in the vertical direction brings further advantages which we have listed above, and which are not without importance.

In addition, the accelerometer diagrams can be plotted and assessed by experts to investigate certain problems (compare above resonance), and in particular cases conclusions can be drawn regarding the dynamic loading or the extent of the impact blows.

IV. CONCLUSIONS

As stated above, the Conference on Safety in Mines in March 1957 recommended further development of devices for checking shaft guide installations (in particular accelerometers), to achieve easier handling of such devices by the officials responsible for the shaft.

The study of the accelerometer has shown that this device is suitable not only for checking shaft guides, but also can give useful information in checking the operation of the winding installations in general terms.

Some of the accelerometers briefly described above have, moreover, features which make them easier to use by the shaft officials:

- robustness and rapidity of setting up,
- diagrams which can be directly read off (i.e. without photographic development or enlargement),
- purely mechanical operation or at the most requirement for low current sources (to avoid the necessity for extensive flameproofing in gassy shafts).

The Mine Safety Commission wishes the experiments of accelerometers to be continued on a broad basis and hopes to see the use of these devices extended. The Commission does not, however, think it desirable at the present state of the art to prepare a recommendation regarding use for the officials entrusted with the routine checking of shafts.

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ANNEX VI

R E P O R T

of the Working Party on "Winding Ropes and Shaft Guides" on the Electro-magnetic examination of winding ropes (investigation, tests and assessment).

(Approved by the Mines Safety Commission at its Plenary Session of 20.7.65)

Electro-magnetic investigations of winding ropes were carried out in Mülheim, Waterschei, Merlebach and Bochum at the request of the Mines Safety Commission and with the financial support of the High Authority.

The present document comprises

A. a historical sketch of the problem,

B. a report on the present state of electro-magnetic testing techniques,

C. an assessment, giving the Working Party's view.

A bibliography of source material is included as an appendix.

A. Conference Recommendation and terms of reference of the Mines Safety Commission

In March 1957, the Conference on Safety in Coal Mines adopted the following Recommendation: "Methods for testing winding ropes in service, e.g. electro-magnetic rope-testing techniques, should be further developed (Conference Report, item 31-M, page 148).

At that time the condition of a winding rope in service was essentially assessed on the basis of visual examination. By this means it was generally possible to detect with the naked eye broken wires on the surface of the rope. But other indications are also used to judge the condition of the rope; for instance, the rope is examined over its entire length to see the extent of rusting or wear of the external wires, and the looseness or otherwise of the rope is tested, as are local changes in rope diameter and the length of lay of each individual strand.

On the other hand, the condition in the interior of the rope is very difficult to judge by examination of the external appearance. To a certain extent, it is possible to obtain some idea of the internal condition by tapping with a hammer. In doubtful cases the examiner has the rope twisted open or orders the removal of a wire, to enable him to examine this wire over its entire circumference and then to assess the surface of one wire in the next inner layer, which has been revealed by the gap left by removing the first wire.

It is however possible to use these different, decidedly not very reliable methods only at certain places along the wire, and they do not always provide an accurate assessment of the rope over its entire length.

Winding ropes of simple construction are more easily inspected and assessed in this manner, since after each length of lay a large part of the wires appears at the surface of the rope again.

The increasing application of ropes of complicated construction (including different types of locked-coil rope) brought about by increases in the effective load carried and by the necessity to wind from greater depths, cannot be assessed sufficiently accurately by an inspection of the exterior. Because there are a number of superimposed layers of strands and the individual wires are arranged in several layers in each strand, by far the greater part of the wires remains hidden from the examiner's view.

These considerations led to the formulation of the Recommendation quoted above, based by the Conference on the following statement:

"The object of this Recommendation is to promote the development of test methods which can be applied by rope inspectors at the pit and used by them to make assessments. These methods are of particular importance for ropes with internal strands, since in this construction breaks in the wires of internal strands cannot be detected by normal testing".

The Working Party on Winding Ropes and Shaft Guides, set up by the Mines Safety Commission on March 17, 1958, was charged with the investigation of this problem.

The investigation began in the very first session of this Working Party on July 18, 1958 and continued for a period of more than six years, the whole series of documents and relevant specialist literature being consulted, as well as experts in rope-testing techniques and representatives of rope manufacturers.

Until the termination of the investigations of the Rope-Testing Station in Bochum in September 1964, the examination of this problem can be divided into three periods, viz.

1. Investigation of the current position of electro-magnetic testing of winding ropes (1958/1959)
2. Comparative investigations of winding ropes in service (1959)
3. Execution of the test programme using winding ropes withdrawn from service, at the Rope-Testing Station, Bochum (1960/1964).

B.I. The state of the technique of electro-magnetic testing of winding ropes (1958/1959)

After a most exhaustive exchange of views, with the aid of various documents made available by members of the Working Party, it was possible to establish the position at that time of electro-magnetic testing of ropes.

In the coal-producing countries of the Community and in the United Kingdom, there was already a certain body of experience with the electro-magnetic testing of winding ropes in service. In each of these countries a particular type of apparatus was in use, generally being operated by specially-trained experts attached to a testing station.

The devices in service in Belgium, Germany and France may be considered as the most highly developed.

In Belgium, the A.I.B. ("Belgian Industrialists' Association") had further developed an electro-magnetic testing apparatus whose operation could be considered satisfactory - based on the series of comparisons made up to that time between faults in the rope indicated by the recording charts and those actually found when the rope was withdrawn from use. In the opinion of the A.I.B., this apparatus makes it possible to determine the estimated loss in load-carrying capacity (P in %). Tests carried out in Belgium after the withdrawal of ropes from service had shown that the actual loss generally lay between P + 5 and P - 5.

In Germany, the Rope-Testing Station at Bochum had finished perfecting a testing device which had been used since 1930.

In France, the "French Industrialists' Association" employs the Integra-apparatus.

In the opinion of the experts, these two devices also performed satisfactorily.

Difficulties were encountered in all three countries in the interpretation of the diagrams recorded. It is in particular very difficult to distinguish between different kinds of rope damage and consequently it is also difficult to determine precisely whether the loss in load-bearing capacity of a rope is to be attributed to wear, corrosion or broken wires, inter alia. Moreover, damage due to similar causes were differently indicated in the recorded diagrams according to whether the damage points were situated in the interior of the rope or on the surface.

Initially there were either no contacts at all or only very slight contacts between the various institutes using these devices. It was the National Coal Board which for the first time arranged comparative trials, most of the Community countries being represented. The tests were carried out on two ropes: one in which various faults had been deliberately simulated and a similar fault-free rope. The results of these trials were not always satisfactory, but they did give some indications for future trials to the rope-testing experts familiar with the different types of apparatus.

After this exchange of views, which was accompanied by considerable efforts to take in all the topical problems in this field, it was possible to establish that at that time electro-magnetic rope testing could provide certain indications when the diagrams were interpreted by experts, but that it was not yet a technique to be put into the hands of the colliery rope-testers.

At this point of time, certain experts did however hold the view that the test method consisting of opening a rope at suspected points and removing wires for testing ought to be replaced by other methods of investigation.

No agreement was reached as to the utility of mathematical analysis as a means of calculating the loss in load-bearing capacity of the ropes.

B.II.-1. Comparative investigations of winding ropes in service (1959)

It was unanimously decided, that in the first place the possibilities and limits of application of the apparatus used at that time should be examined, although not all the members of the Working Party had the same confidence in the development of the technique of electro-magnetic testing of ropes.

This investigation was to be achieved by continuing the comparative tests begun by the National Coal Board, but after changing the method, in that, for the purpose of these tests, ropes in service were selected which had genuine damage and faults, and which were to be withdrawn from service shortly afterwards.

The aim was to ensure that a relation could be established, as quickly as possible, between the faults recorded in the diagrams and the faults visible to the naked eye on the rope when withdrawn from service.

The above-named three testing devices were selected for these tests; ropes of various types of construction were employed as test pieces.

Tests were carried out on April 11 and 12, 1959, at the Rosenblumendelle Pit in Mülheim (Germany), on April 25, 1959, at the André Dumont Pit at Waterschei (Belgium), on June 21, 1959, at the Freyming Pit at Merlebach (France) and on October 3, 1959, again at the Rosenblumendelle Pit; after these tests certain sections of the ropes which had been subjected to test and subsequently withdrawn from service were compared with the recording charts. These comparisons were carried out on May 14, September 7 and October 14, 1959, in the A.I.B. Laboratories in Brussels, the Rope-Testing Station in Lens and the Rope-Testing Station in Bochum. On November 5, 1959 the results of these comparative studies were tabled and were exhaustively discussed by the Working Party.

During this operation the Working Party came to the conclusion that the diagrams recorded by the test apparatus gave accurate results only when the speed of movement of the rope under test was kept as nearly as possible constant (1). The Working Party also formed the opinion that conclusions with regard to the state of the rope at any time could be drawn from differences between successive diagrams.

In order to assess the general state of the rope, the diagrams could be examined in respect of various criteria; particular attention might, e.g. be given to the presence of strong deflections of the recording pen - indicating broken wires - or to the presence of less obvious irregularities (changes in the background noise level) - indicating other faults, such as rust, wear, indentations, etc.

In each case both criteria should be taken into account.

In assessing the diagrams for the first of these two factors, it was found that individual breaks of external wires were clearly indicated. According to the depth of the point where the wire has broken in the body of the rope, a clear indication is possible only if the number and extent of the breaks is correspondingly greater.

Testing for the second factor, i.e. measurement of changes in the background noise level provides qualitative information about the state of the rope; nevertheless, experience has shown that it was not possible to deduce a sufficient body of accurate quantitative data. Moreover, assuming the sample length had been properly marked (reservation expressed by one of the experts),

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(1) To compensate for this shortcoming, the Bochum apparatus includes a device which ensures undistorted diagrams even when the rope speed is not constant.

one of the four tests referred to above, with subsequent opening-up of the rope, showed a low amplitude of background noise associated with a considerable loss in load-bearing capacity. Thus the opposite of what might be expected can occur. If the diagrams obtained by electro-magnetic tests are not carefully interpreted, dangerous conclusions may be drawn.

The results of these comparative tests allowed the conclusion to be drawn that the technique of electro-magnetic testing could not by itself give information about the state of a rope, although the rope spectre could deduce certain facts with regard to its state from the tests.

2. Tests of an apparatus operating on alternating current

In order to include in this investigation an electro-magnetic rope-testing apparatus working on low-frequency alternating current, there was made available to the Working Party for trial purposes - through the intermediary of the British Delegation - the apparatus used in South Africa and known as the "Phase shifting electro-magnetic testing unit", this being arranged after some experts on the Working Party had already taken part in the trials organized in England by the National Coal Board. The apparatus was successively tested at the establishments of the Association des Industriels de Belgique, the Seilprüfstelle in Bochum (Bochum Rope-Testing Station) and the Association des Industriels de France. The members of the Working Party were able to be present during the tests in Bochum.

The experience gained in these institutes led, however, to the view that this apparatus did not seem suitable for the continuous inspection of winding ropes under the operational conditions obtaining in Europe (Doc. 2911/62).

The Belgian Delegation submitted to the Working Party a report - which went into great detail - on their theoretical investigations and practical experience with this device (Doc. 8264/62); the French Delegation also submitted a paper on this apparatus and expressed their views regarding the theories developed by Messrs. Harvey and Krüger (Doc. 6759/64).

B.III. Execution of the programme of tests on winding ropes withdrawn from use at the Bochum Rope-Testing Station (1960-1964)

The Working Party agreed unanimously that the solution of certain problems which constantly came up during the discussions had become a matter of priority, if the uncertainties attached to the interpretation of the recordings were to be reduced and mistakes to be avoided; these problems were:

The detection and identification of the various factors which affect the load-bearing capacity of the rope, such as rust, wear, identations, breakage of internal wires, the crystalline state of the wires, the magnetic states of the rope during the electro-magnetic test.

The French Delegation held the view that unsystematic individual tests, however interesting that might be taken in isolation, were not adequate for the solution of the problem. They are however convinced that progress in this field could be made by adopting the following measures:

The obtention of numerous diagrams by different establishments (A.I.B., Bochum Rope-Testing Station, A.I.F. and all other interested bodies) using various types of rope construction working under different conditions;

The examination of successive diagrams to determine developments in time;

The systematic comparison of these diagrams with samples of withdrawn ropes;

Finally, the assembly and publication of the results.

The Belgian Delegation was of the opinion that a major step solving the problems of electro-magnetic testing of ropes could be brought nearer by undertaking basic research to determine precisely the conditions for rope tests, so as to be able to keep the various factors causing wear or deterioration separate.

They therefore suggested that this basic research be carried out, and considered the achievement of the following aims to be important:

- starting with the known parameters of electro-magnetism, basic theories covering the electro-magnetic testing of ropes should be worked out, with particular reference to the selective detection of each type of fault;

- starting with the theories worked out in this way, one or more prototypes of testing devices should be built, of such design that selective detection was most likely to be realized and also, as far as possible, providing for the measurement of one or more types of deterioration;

- following experimental tests in the laboratory, the prototype should be improved and adapted to the conditions governing experimental tests at a pit;

- pithead tests should then be carried out.

After examining these two proposals, the Working Party agreed that for the time being the practical investigations should be continued.

To this end it was decided that withdrawn winding ropes of various types should be tested with the same apparatus by the same institute. Once these practical investigations had been finished and their results checked, the proposals advanced by the Belgian and French Delegations could be re-examined.

On April 8, 1960, the Mines Safety Commission approved the programme of tests worked out by the Working Party and recommended the High Authority to support the programme financially.

The High Authority took cognizance of this problem on June 23, 1960, and approved financial support for the following programme of investigations:

1. Thirty winding ropes of various types should be made available from different Community countries in the space of 6 to 8 months approximately.

2. The winding ropes should be tested by electro-magnetic means in the country of origin, shortly before being withdrawn from service.

3. The sample sections (some three pieces each 8 metres long) should be selected on the basis of the recorded charts.

4. The sample pieces selected should be marked by coloured rings and by the removal of 1/2 external wires at each end.

5. After withdrawal of the rope, the sample pieces should be cut out. The cuts should be made approximately 0.5 metre beyond the coloured rings and artificially-produced wire breaks, so making the total sample length some 9 metres. The ends should be very tightly bound or welded, to ensure that the sample did not become loosened during transport. The beginning of each sample piece should be marked by a special marker, such as a flag or label.

6. The rope should then be subjected to electro-magnetic tests once again, with special attention to the individual sample lengths, to determine the sections of the diagram corresponding to the marked samples.

7. The three sample pieces from the withdrawn rope and a sample piece of the same rope in new condition, as far as possible of the same length, should be sent to Bochum (for comparison purposes).

8. Each sample piece should then be electro-magnetically tested using the Bochum testing device in the Bochum Rope-Testing Station.

9. A section of rope of approximately 60 cm long should be removed from each sample piece for the examination of individual wires (tensile, bending and torsion tests).

10. A further section of rope some 4 metres long should be taken from each sample piece to be submitted to a destructive tensile test on the whole piece.

11. The remaining length of each sample piece should be unravelled and the individual wires examined.

12. Samples of ropes of various constructions were provided for these tests from Belgium, Germany and France, after having been submitted in the country of origin to electro-magnetic tests.

13. The tests were carried out in accordance with instructions, although delays arose because suitable ropes became available only at irregular intervals.

The results of the tests with the Bochum apparatus were examined and discussed in detail for the first time by the members of the Working Party at their session of December 17, 1964 (Doc. 6116/64 dated 14.9.64).

The Working Party noted that new methods had been used for the first time in assessing the actual condition of the rope, as revealed when it was unravelled, since no reliable criteria for this purpose already existed.

Individually, the results achieved can be formulated as follows:

- The changes in background noise level are undoubtedly an index of changes in the rope. When the noise level rises, this indicates faults in the rope, but their effect on the load-carrying capacity of the rope will vary.

- Thus, e.g. the strongest signal is given by external rusting. Internal rusting of the same order of magnitude gives rises to a weaker signal, as one would expect from the principles of electro-magnetic testing. Wear gives a much weaker signal than corrosion: similarly, internal wear gives an even weaker indication than external wear. Broken wires give differing signals according to their position and cross-sectional area. There are even physical limits which govern certain signals (cf. Section 3 of the Report of the Bochum Rope-Testing Station).

- Since the indications signalled for the various parameters such as corrosion, wear, indentation points etc., vary according to their position in the rope, and these two factors - type and position - are not known while the rope is still in service, it is not possible to make any reliable deductions with regard to load-carrying capacity from increases in the background noise level. There is thus no fixed relationship between the loss in load-carrying capacity and the noise level.

C. Report in respect of the application of electro-magnetic testing devices for the non-destructive testing of winding ropes during operation

1. The investigation of numerous recordings obtained with the various devices for electro-magnetic rope testing and the comparison of these charts with the information yielded by unravelling the ropes so tested makes it possible to conclude that it is possible, by the use of these devices,

   - to locate rapidly major faults in the rope,

   - to detect broken wires in many cases and

   - to study the progress in time of changes in the rope.

2. The Working Party noted, on the basis of the results obtained from the research carried out under their control, that

   - no solution can be expected to the problem of identifying the individual causes of deterioration, such as corrosion, wear, indentation points etc., at the present time;

- no precise indication of the loss in load-carrying capacity of the rope can be obtained from the recorded charts.

3. Consequently, the Working Party is of the opinion that electro-magnetic testing is a useful aid to the assessment of winding ropes, although the interpretation and the diagrams is in many cases a difficult matter.

4. From which they conclude that

   - the test apparatus should be used only by experts, who must be fully aware of the limits and shortcomings of the method as well as with the type and behaviour of the various types of rope, in order to avoid wrong judgments;
   - electro-magnetic testing cannot replace, but can simply supplement the usual classical testing methods such as visual inspection, tapping, twisting the rope open (where possible), removal of one wire.

5. To sum up, the Working Party considers that the electro-magnetic testing method can, suitably applied and in association with the traditional testing methods, contribute to the safety of man-riding in shafts.

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ANNEX VII

REPORT

on investigations into the protection of underground electrical networks against dangers arising from fires or firedamp explosions (with Recommendations)

(Approved by the Mines Safety Commission at its Plenary Session of 27 and 28.4.1964)

When the Mines Safety Commission approved the draft of Recommendations for the protection of underground electrical networks against the risks of electric shock, worked out by the Working Party on "Electrification", at its Session of 8th April 1960, it was pointed out that these electrical networks must also be protected against risks arising from fires or firedamp explosions.

Reference was made to this new factor in connection with a serious accident in Great Britain, in which a short-circuit in a cable, which released considerable quantities of energy, had initiated a firedamp explosion, although the protective devices in the electrical system against overload and leakage had been tripped.

The Mines Safety Commission wishes the investigation of this problem to cover not only underground medium-tension networks (as was the case in connection with the risk of electric shock) but above all to the problems of using high-tension currents.

The investigation of the protective measures against fire and firedamp explosion risks applied in several countries, as well as the progress which has been made in this field in recent years, made it possible for the Working Party to present several draft Recommendations to the Mines Safety Commission regarding the protection of underground electrical networks against

1. - Dangers arising from fires
2. - Dangers of firedamp explosions.

In addition, supplementary Recommendations were prepared aimed at reducing the risk of explosions in pits liable to sudden outbursts of gas.

The Working Party considered it appropriate to precede these Recommendations with a series of definitions, which have in fact already been largely presented at the beginning of the Recommendations on the risk of electric shock.

Definitions

1. Network: Any system of current source, means of transmitting current and current-consuming apparatus. Thus e.g. the secondary winding of a transformer (or the secondary windings, if several transformers are present with secondary windings in parallel) and the components fed thereby constitute a network.

2. Voltage: Effective voltage between phases in the case of three-phase alternating current.

3. Designation of the Voltages:

N.B. The following designations are used solely for the purpose of the present recommendation and are without prejudice to the classifications normally used in the individual countries.

a) Weak tension (WT) : Voltage range which may be considered safe (generally between 40 - 65 V according to country).

b) Low tension (LT) : Voltage range for lighting purpose, drilling operations, telephone installations etc. (65 - 380 V).

c) Medium tension (MT) : The normal voltage range for working equipment used underground with three-phase A.C. (between 380 and 1,100 V).

d) High tension (HT) : The normal voltage range for the primary winding (between 1,100 and 12,000 V) of the transformers supplying the MT- and LT-networks.

4. Electrical protection of the cables:

The term "electrical protection" of the cable is to be understood to cover any device intended to break automatically the connection with the power supply to the cable before the consequences of any fault occurring in the cable can become dangerous.

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<u>NOTE</u>: Experience gained at a Dutch pit with the experimental application of direct current has led to the following remarks:

a) The present Recommendations refer to alternating current.

b) With some modifications they also hold good for direct current.

c) A similar Report should be prepared if direct current becomes more widely used.

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1. RECOMMENDATIONS REGARDING THE PROTECTION OF UNDERGROUND ELECTRICAL NETWORKS AGAINST DANGERS ARISING FROM FIRES

In this draft, which is based on the same considerations and prepared in similar form to the Recommendations in connection with the dangers of electrical shock (Doc. 8384/59/4), three categories of precaution are to be defined in respect of fire risk; it is only by the simultaneous application of these precautions that sufficient protection for the underground electrical networks can be guaranteed:

- The first order precautions are intended to avert the danger (preventive measures);
- The second order precautions are intended to hinder any fault having serious consequences (protective measures);
- The third order precautions are intervention measures which have the disadvantage that the installations have to be switched off: before applying the measures proposed in these Recommendations, consideration must be given to the local dangers which may arise as a result of switching off.

A.- FIRST ORDER PRECAUTIONS AVERTING DANGER FROM FIRE

1. An excessive degree of heating in normal operation of cables and leads and of plant components under voltage should be prevented by the provision of adequate conductivity, allowing for the maximum loadings occurring in operation. Unforeseen local heatings, caused by the loosening of terminals and connections, should be prevented by the use of suitable designs and by proper supervision as far as possible.

2. The possibility of faults and short-circuits between leads or between leads and earth should be prevented by suitable insulation or by an adequate gap between the leads.

B.- SECOND ORDER PRECAUTIONS - Protection against the effects of a heating or a fault:

1. The insulations used in the manufacture and installation of electrical machines and cables and leads should not undergo change as a result of the heating effects during periods of maximum operating load.

2. The protective sheaths for machines and for cables and leads should as far as possible be made of material which is flame-resistant or which does not spread fire.

   The use of oil as a non-conductor should be permitted only in cases where appropriate precautions are taken to avoid any risk to the personnel in the event of fire.

3. Concentrations of ignitable or combustible materials and pipes for combustible gases should be sited as far as possible from the electrical equipment.

C.- THIRD ORDER PRECAUTIONS - Acting on the network

1. The networks should be automatically protected against overloads by suitably selected, adjusted, inspected and maintained relays, switches or other equivalent devices (1).

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(1) The network is naturally considered as being properly protected if the protective device interrupts only the supply to the apparatus or the cable in which the fault has occurred.

2. The networks should be automatically protected (1) against short-circuits by means of protective devices - e.g. fusible plugs, circuit-breakers, etc. - or by the combined use of these devices, all these devices to be capable, on switching off, of handling the maximum possible short-circuit current which can occur at the point where they are installed.

   These devices should be chosen and adjusted according to the lowest short-circuit current which can occur at the end of the section of network which they protect.

   Switches, relays, protective devices against short-circuits, etc. should, on switching on, be able to cope with the maximum short-circuit current which can occur at a point where they are installed.

   Should the power involved in the short-circuit on switching off require it, the speed of movement of the switch contacts should not depend on the amount of physical energy exerted by the operator in the case of hand-operated switchgear.

3. Measures must be taken to ensure that as far as possible there is effective protection against faults with low current intensity which would fail to trip the protective devices named above and could cause dangerous heatings.

COMMENTARY

1. The present Recommendations regarding protection against dangers arising from fires in underground operation apply to all voltage categories above 380^{o} (medium tension and high tension as set out in the definitions of the present Report). These Recommendations are also in principle valid for lower voltages, but do not need to be observed so strictly if the possible fault current remains low.

2. To ensure the safety of the workmen, three classes of precaution are recommended here and it is only by simultaneous application of them that adequate protection of the installations can be guaranteed. What is more, the distinction drawn between the three categories is only based on logical grounds - to ensure that nothing should be overlooked; this does not however mean to say that the first order precautions take precedence over the others. In some instances it could, in fact, happen that a rapid and reliable intervention would be quite sufficient. However, working safety must not depend solely upon devices whose method of operation has been shown to be unreliable in practical working because of their inadequacy or because they have been wrongly chosen, or because of damage or neglect.

A.- FIRST ORDER PRECAUTIONS (preventive measures)

1. To avoid heatings and fires caused by electrical equipment, it is above all things necessary that the various magnitudes in the network (in particular the cross-sectional area of the cables) are selected so that the temperature of the leads or of the installation only reaches a moderate level even during the heaviest loadings in normal operation (including starting-up of the motors), these moderate values being compatible with the strength of the insulation; from this point of view it may on occasion be desirable to have an increase in voltage to reduce the higher current intensities and their effects.

2. The permissible current density depends on the surroundings, the design of the equipment, duration and frequency of operational loading; there is thus no general simple rule to determine the permissible limits beforehand. Each country does however have regulations which are based upon general experience;

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(1) The network is naturally considered as being properly protected if the protective device interrupts only the supply to the apparatus or the cable in which the fault has occurred.

these regulations make it relatively easy to determine for each individual instance the prerequisite conditions for the design of the networks, taking these factors into account.

Regular checking of the networks is moreover advisable. Sometimes there is a great temptation to connect further devices to an already fully-loaded network, the working times of the new apparatus perhaps coinciding with that of the existing devices. In addition, a loosened connection can be the cause of equally severe accidents as can an overload. The Recommendations with regard to the dangers of heatings must therefore deal with both the causes occurring in normal operation (excessive current loading) as also with unusual causes (excessive extent of the network, loosening of connections, etc.); in particular the use of connections with antiloosening devices is recommended.

2. Naturally the measures to prevent excessive heating should be supplemented by measures to prevent short-circuits; this is done by using suitable insulation or by maintaining a proper distance between conductive components which may have different potentials, or by extending the air gaps, or by precautions of all kinds to avoid leakage currents.

B.- SECOND ORDER PRECAUTIONS (protective measures)

1. To prevent any heating having unpleasant consequences, the corresponding rise in temperature must not cause damage nor major changes to the insulation; this is the purpose of the first Recommendation here listed. In this connection it must not be forgotten that the thermoplastic insulation materials (PVC type) do not resist heat as well as e.g. impregnated paper.

2. It cannot be expected however that the material will have the same degree of resistance to heat effects attributable to short-circuits if these are of long duration; it is in many cases technically impossible to use inorganic or non-combustible materials since they may produce other dangers (e.g. as a result of the brittleness of these insulating materials).

   On the other hand the attempt can be made to make the material and the cables and leads flame-resistant, both against external influences and against fire from short-circuits. Assuming that this fire does not last too long, it is thus insufficient to surround the cables and apparatus with a sheath which does not spread the fire.

   Oil calls for special mention. As in the case of the other combustible non-conductors, the use of oil should be governed by the precautions taken to protect the workmen in the event of a fire; this problem has already been dealt with in detail in connection with oil transformers and oil-filled switchgear and will therefore not be further discussed here.

3. Finally, as far as possible, no combustible materials should be stored in the vicinity of the electrical equipment and there should be no pipes carrying combustible gases. Here again this can be taken only as a Recommendation in principle; it is in practice unavoidable that e.g. wood should be stored near the working-points and the apparatus situated there. Efforts must however be made to restrict these practices as far as possible.

C.- THIRD ORDER PRECAUTIONS (intervention measures)

The conventional protective apparatus tripped by the current intensity (fuses, relays, circuit-breakers, etc.) are precisely intended to ensure that any overloads or short-circuits which occur do not last long enough to cause a fire.

1. Ideally, to give protection against overloads, it would be necessary to have components which are able to integrate precisely the variations in loading in a network or in a protected cable. But, as has been found in practice, certain devices which are intended to give a precise picture of the thermal conditions

turn out to be complicated and unreliable; the operating conditions underground in general call for the use of more robust elements, even if their selection or adjustment makes it necessary to apply a higher degree of safety precaution.

2. The higher the short-circuit current rises above the normal loading of the network (including starting-up of the large motors), the easier the short-circuits are to control. For example, fuses or magnetic cut-outs are adequate to provide a circuit-breaking system, provided that their switch-off capacity is sufficient to cope with the maximum current intensity possible at the point in question.

   In addition the fuses must be so chosen and the relays so adjusted that the protection is also provided even for the lowest possible short-circuit current at the end of the cable being protected or, to express it more precisely, the protective devices must be selected in such a manner that normal overloads are possible with an adequate degree of safety, without there being any danger of heating of the fuses or an untimely tripping of the relays. This therefore means that appropriate adjustment of the protective devices tripped by current intensity can be a very difficult matter, if the cross-sectional area of the copper lead is too small, if the cable is too long or the resistance of the current source too great. To eliminate this eventuality, it is possible to have recourse to protective devices against resistance-governed faults, as provided in paragraph C.3.

   The devices for closing the current circuit (switches and relays) must in addition have a high enough switch-off capacity to eliminate any possibility of switching-off not occurring, not only in the event of any overloads which may occur, but also at maximum short-circuit current.

   The hand-operated devices for switching on or off - switches, relays, etc. - must be designed so that the switching speed does not depend on the physical energy exerted by the operator, when dealing with high powers. As in the previous case, this precaution is directed against failure to switch off in the event of a short-circuit.

3. To protect the network against disturbances from low current intensities caused either by a continuing fault between phases or between phase and earth, or even by a partial or complete break in one phase (broken lead, badly-fastened cable clamp, etc.), certain precautions should be taken e.g. to restrict the extent of loading of the electrical networks or to make it possible to use automatic cut-off devices to the extent that these devices are suitable for the determination of faults of this type and allow of intervention before these faults become serious.

   This provision must naturally not be applied too strictly; there is no such thing as a completely insulated electrical network, and fault currents only become dangerous once they exceed a certain threshold intensity.

   It should also be pointed out that the tripping time must be shorter, the stronger the current flowing through the fault point. The reaction time of the normal devices is moreover generally adequate from this point of view if they are suitably adjusted.

2. RECOMMENDATIONS ON THE PROTECTION OF UNDERGROUND ELECTRICAL NETWORKS AGAINST DANGERS ARISING FROM FIREDAMP EXPLOSIONS

The following Recommendations are in principle intended only for gassy pits. Pits subject to sudden outbursts of gas are covered by several supplementary remarks in an annex.

Without prejudice to the precautions proposed for protection against electric shocks and against dangers arising from fires, a distinction is drawn here between supplementary precautions of first, second and third order; it is only by their simultaneous application that adequate protection of the underground networks can be ensured.

A.- FIRST ORDER PRECAUTIONS - Prevention of accumulations of firedamp

1. Precautions should be taken to ensure that the firedamp content at the point where the electrical equipment is installed should remain below the threshold values laid down by the responsible Inspectorates.

2. Before the installation of any new electrical equipment or before any extension of an existing installation, the ventilation conditions at the site should be checked in the sense of the previous Recommendations.

3. Before any changes are made in the working system, in the ventilation or in the gas-drainage system which could cause disturbances in the vicinity of electrical equipment, the responsible official must examine in detail the possible consequences of these measures.

B.- SECOND ORDER PRECAUTIONS - Protection against the risk of ignition

1. In gassy workings, use should be made only of electrical equipment and installations which have been permitted or approved by the responsible Inspectorate, and only under the conditions laid down by them.

2. The electrical equipment should be erected, used, inspected and maintained in such a way that it remains flameproof. It should be supplied only by cables or leads which are of adequate mechanical strength bearing in mind the site and use.

   Efforts should be made to avoid any damage to the cables and leads when they are laid or when the workings around the equipment are being maintained.

C.- THIRD ORDER PRECAUTIONS - Cutting off the current

1. The networks should be laid out in such a way that any possible fault current between phase and earth is reduced to a low value or rapidly broken.

2. Preference should be given to an automatic protection device - either collective or selective - against faults between phases and against earth faults.

3. Precautions should be taken to exclude the risk of accidents to men when looking for faults or when localizing them, and when the sections of network in question are switched on again.

4. Leads without metal sheathing, and especially leads supplying current to moving machines in the workings, must be electrically protected against internal or external short-circuits, either by a screen round each individual conductor or surrounding all the conductors, this screen to bring into action in the event of a fault a protective device - or by the use of equivalent systems.

5. If the firedamp content rises above the threshold values laid down by the responsible Inspectorate, all the affected sections of the network should be switched off. Appropriate instructions should be issued - bearing in mind the local conditions - and in particular, allowance should be made for the necessity of maintaining in operation certain machines which provide ventilation.

   These sections should be switched on again only after it has been established that the firedamp content has dropped below the prescribed threshold level, and that only on the instructions of an expert official.

COMMENTARY

To protect underground networks against dangers arising from firedamp it is above all necessary to prevent accumulations of firedamp (preventive measures); should a dangerous concentration of firedamp nevertheless arise, it is essential to prevent any ignition (protective measures) by the electrical equipment, and finally to switch off the network before any risk of explosion occurs (intervention measures).

Here again we are dealing with three categories of precaution which have to be applied in association with each other and which are additional to the precautions proposed in connection with electric shock and fires.

A.- FIRST ORDER PRECAUTIONS (Preventive measures)

1. The prime purpose is to prevent any rise of the firedamp content in the workings in which electrical equipment is situated. The appropriate ventilation or gas-drainage measures are in any case required for many other reasons, but they become even more vital because of the use of electrical equipment, and it therefore seems necessary to emphasize their importance and to recall that the Inspectorate in each country lays down the maximum permissible firedamp levels for workings where electrical equipment is situated.

   The precautions recommended here particularly refer to the local danger of accumulations of firedamp and the frequency of checks.

2. For this reason, any installation of new electrical equipment or any major extension of an electrical installation in gassy pits or in gassy districts should be accompanied by a new check of the ventilation conditions in the vicinity of the electrical equipment, this check, to be made by the officials responsible for ventilation.

3. Similarly, in every case of a change in the ventilation or the working method which might give rise to a change in the firedamp concentration in the vicinity of the electrical equipment, these changes should not be carried out without thorough reflection and without taking all the precautions called for; all the responsible officials, in particular those responsible for the electrical equipment, should be brought into the discussion of these precautions.

B.- SECOND ORDER PRECAUTIONS (Protective measures)

1. In districts classified as gassy it is important that the only equipment used should be such as gives no risk of ignition of firedamp, i.e. only designs which are approved or permitted by the responsible Inspectorates. Various types of protection can be used to achieve this (1); it is the Inspectorates' responsibility to lay down the field of application and conditions of application for these types of protection.

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(1) Classified as "Types of Protection" in the International Electro-Technical Commission's list.

2. The supervision and maintenance of the equipment and the cables and leads, particularly with regard to risk of ignition of firedamp, is of great importance; it should be the responsibility solely of precisely-instructed personnel. Similarly, no effort is too great to ensure that the workmen who have to handle electrical equipment are properly informed, in order to avoid any impairment of the working life or the operation of the equipment by incorrect or rough handling. A long period of patient education is necessary; such measures undoubtedly have an economic value and directly influence safety.

   Even the construction of the cables used is not unimportant: their mechanical strength must be suited to the special conditions of underground work. With regard to resistance to blows, for example, it may be useful to draw attention to the use of cables with elastic components; thus it is better to use the "dry" cables than paper-insulated cables with a lead outer sheathing, provided that the risk of any modification of the dry insulating material by heat is adequately restricted.

C.- THIRD ORDER PRECAUTIONS (Intervention measures)

These measures are primarily intended to eliminate the causes of ignition of any possible explosive or combustible mixture of gases which may arise.

Since a few milli-joules are sufficient to ignite a firedamp mixture, the prime purpose of these precautions is to eliminate or reduce every possible cause of spark or arc formation or any external heating.

The precautions therefore consist of:

a) protection of the network by means of the precautions already listed against the risk of electric shocks and against dangers arising from fire. Electrical protection should above all be provided for leads to moving machines. However, apparatus working on low voltages (e.g. drilling machines) can often dispense with such protection.

b) Additional precautions with the following aims:

   - Reduction in the intensity of any fault currents which may occur, which can e.g. lead to preferring an insulated star-point (or one earthed via a limiting resistance) to an earthed star-point and (selective or collective) insulation supervision with automatic switching-off of a control device provided only with a signal indication or to exclusive protection against double faults. However, the possible difficulties of restricting faults prevent excessive strict application of this rule. On occasion the observance of precise instructions by expert workmen may be preferred to the use of this automatic device.

   - Reduction of the duration of the fault to the absolute possible minimum, the consequence of which is that the circuit must be broken as quickly as possible, requiring the use of sensitive and rapidly-operating protective devices.

   It will however be noted that in a case of serious damage (rock falling on cables and leads or on cable inlets, a cable cut by a machine, etc.) these two precautions do not have the same effect. The arrangement of the equipment at the working-point frequently makes the first precaution more important than the second since dangerous concentrations of gas form more rarely in the direct vicinity of the equipment; in this case it is even more necessary to avoid fairly large faults and their consequences than to break the circuit very quickly.

   Thus it is preferable - except for certain special cases - to use resistant and robust equipment (above all if it only has to operate rarely) to protective devices which operate rapidly but are weak and too sensitive, since if one of them became effective at the wrong moment the workmen might make it ineffective (1)

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(1) At this point there arises the difficulty - indeed the danger - that the safety devices are inadvertently used simultaneously; they should only be used in fairly large numbers to the extent that their technical characteristics are improved and above all to the extent that the discipline of the workmen, and their specialist training is improved, and their capacity to appreciate the dangers which they may bring upon themselves is increased.

or since a failure might cause the intended protection to drop out. Naturally attention has to be paid to selecting the protective devices with the best features in respect of robustness, rapidity and sensitivity compatible with the technical conditions obtaining.

- Indication of the danger, indeed automatic breaking of the circuit when the firedamp content increases or when the ventilation decreases.

  This precaution is arguable, since each device only checks one point and any concentrations of firedamp may occur elsewhere. Until better apparatus is developed, preference must be given to regular checking by the personnel.

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REMARKS REGARDING PITS LIABLE TO SUDDEN OUTBURSTS OF GAS

The term sudden outburst of gas is to be understood in what follows to cover a sudden and severe outburst of gas which is generally accompanied by the projection of coal and rock.

The use of electricity in pits liable to these phenomena or at such working-points naturally calls for certain additional precautions, since the outbursts are severe and are in practice difficult to predict. The remarks which follow are not intended to be an exhaustive list of the precautions to be taken, but only to include the most important. Whether and under what conditions the use of electrical equipment can be approved can be judged only by the appropriate Inspectorate from case to case.

These remarks apply to pits subject to outbursts of mixed gases (CO_2 and CH_4) as far as it has not been established that the released gases are incombustible. In the case of incombustible mixtures of gas, any sudden outbursts which arise can only damage the electrical equipment by pieces of rock or coal which are projected. Generally a reinforced mechanical protection or an arrangement of the devices and cables and leads which eliminates any damage will be sufficient to deal with this risk.

If we assume that the electrical networks which may in certain instances be passed for use in pits liable to sudden outbursts of gas already meet the requirements of the Recommendations covering protection against electric shocks and for the prevention of fires and firedamp explosions, then the supplementary precautions required must essentially be directed towards the following three aims:

- Restriction of the danger that electrical devices or live cables and leads can be hit by projected particles of coal or rock.
- Elimination of the possibility that gas clouds with a dangerous content of firedamp can unsuspectedly flow over live electrical equipment.
- Strengthening of the other electro-technical precautions already taken.

1. Danger of damage by the particles of coal or rock projected by a sudden outburst

The points at which there is a risk of sudden outbursts are generally well-known. To avoid any risk of the electrical equipment being damaged at these points by the particles of coal projected, the following measures can be taken as appropriate:

- Protection by removal to a greater distance: The zones in which there is a danger of projection of particles are not electrified.
- Protection by baffles: The electrical equipment and, if required, the cables and leads, are protected by baffles or sheathings which are strong enough to resist heavy blows, or else they are set in niches, behind packwalls, etc.

- Protection by the design: The electrical equipment is housed in containers of adequate mechanical strength, the cables are protected by metal sheathing, by thick elastic sheathings or - in very dangerous zones - by special design precautions (e.g. double screening), so that they are cut off as rapidly as possible if subjected to heavy blows or too strong tension.

2. The danger of clouds of firedamp

The measures which come up for consideration here are, e.g. strengthening of the ventilation current particularly to reduce the risk of accumulations of gas at the site of electrical equipment, and as far as possible the use of remote-indicating methanometers or remote-indicating apparatus for major disturbances of ventilation (in particular for the formation of accumulations); these devices should be capable of cutting off the sections of network threatened by these phenomena, before the formation of a cloud of gas with a dangerous firedamp content; the situation and arrangement of remote-indicating apparatus of this kind naturally depends on its sensitivity and on its speed of response.

Naturally the inducer shots normally fired in pits subject to sudden outbursts can only be fired after all the equipment which could be attained by the gases released during a sudden outburst have been switched off. After this procedure, the equipment may only be switched on again when the air in the vicinity of the electrical apparatus and the associated cables and leads has been checked and, if appropriate, the equipment has been inspected to see that it is still in good mechanical condition and that the insulation is sound.

3. Supplementary electro-technical measures

In this case it is particularly envisaged that there should be a strengthening of the precautions recommended in the case of pits not subject to sudden outbursts but where firedamp is present, so that in particular any fault currents which might occur are restricted to a minimum, efforts being made at the same time to ensure that the intensity and duration of these fault currents are reduced. It is particularly recommended in this connection that the following steps should be taken:

a) With respect to the earthing of the A.C., the use of a star-point earthed via a strong impedance (1) should be preferred to star-points which are earthed directly or via a low resistance.

b) Care should be taken to ensure that there is an automatic protection of the network against all insulation faults, this protection acting as rapidly as possible, even when such faults are formed by resistance between phase and earth; furthermore, provision must be made to ensure that operation can be resumed only after repairs have been finished or after the damaged section of the network has been cut out of the circuit.

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(1) e.g. by using an insulation-supervising device.

ANNEX VIII

R E P O R T

on firedamp-proof electrical switchgear for rated voltages above 1,100 volts.

(Approved by the Mines Safety Commission at its Plenary Session of 16.10.1964)

In a resolution adopted on December 9, 1958, on the elimination of oil from transformers, condensers and other electrical apparatus installed below ground, the Mines Safety Commission noted that the use of firedamp-proof oil circuit-breakers and contactors in places where there was a firedamp risk could not be dispensed with when working with voltages above 1,100 V., by reason of the advantages of these devices with regard to safety in gassy conditions.

The Commission therefore felt that, with a view to eliminating the dangers arising from the presence of oil, research should be conducted for the development of small-oil-volume or oil-less high-tension circuit-breakers and contactors incorporating the properties required for their safe use in gassy workings. To this end, it recommended that a detailed study be made of the greater degree of safety obtainable by making a flameproof casing compulsory for those components which normally emit sparks and by insisting on an "increased safety" type of design for the remainder of the equipment.

After detailed study the Working Party on Electricity can report that research is in progress in the various Community countries for the development of small-oil-volume or oil-less high-tension circuit-breakers and contactors incorporating the properties required for their safe use in gassy workings.

This memorandum reviews the present state of the various techniques applied for this purpose, taking into account that some of these are still in the course of development.

MEMORANDUM ON FIREDAMP-PROOF ELECTRICAL SWITCHGEAR FOR RATED VOLTAGES IN EXCESS OF 1,100 VOLTS

I. SUMMARY OF CERTAIN FUNDAMENTAL CONCEPTS

1. Definition

A "circuit-breaker" is a switch which automatically cuts off an electric circuit from its source of supply in the event of certain faults occurring, e.g. in particular, a short-circuit. It is a protective device.

The actuating (or control) mechanism of a circuit-breaker operates so that on closing it stores up a certain quantity of energy.

The circuit-breaker is opened quickly by means of a latch or trip when this energy is released.

A contactor is a switch for making and breaking an electric circuit. It is an operating device.

In general, contactors are operated electro-magnetically.

The protective and operating functions may be combined in a single unit, known as a contactor circuit-breaker (automatic tripping contactor).

2. Extinction of arcs

When a circuit through which a current is flowing is broken, an arc is formed.

In the case of a short-circuit, the current generally lags behind the voltage in phase.

In other words, as current falls to zero, voltage approaches its peak.

To achieve an effective break, a dielectric strength greater than their potential difference must be established between the two parting contacts.

There are two methods of achieving this result :

(a) Elongation of the arc, which then behaves as a constantly-increasing resistance placed between the poles. The elongation is produced by combining magnetic blow-out and the increase in temperature with various devices designed to break up and cool the arc. This method of breaking the circuit is known as the "high arc-resistance method".

(b) With alternating current, as the current falls to zero, re-ignition of the arc is opposed by a dielectric barrier whose strength depends on the speed at which the contacts separate and the action of a liquid or gaseous de-ionizing agent (oil, water or air). This method of breaking the circuit is known as the "low arc-resistance method".

3. Breaking-capacity of a circuit-breaker

The breaking-capacity is expressed by the highest current which can be broken at a given recovery-voltage without damage or excessive external effect.

The rated breaking-capacity corresponds with a recovery-voltage equal to rated voltage.

II. BREAKING IN OIL - OIL-IMMERSED CIRCUIT-BREAKERS

1. Breaking in oil

When subjected to an arc, the oil decomposes, releasing carbon and gases (hydrocarbons and hydrogen).

A bubble of gas under pressure forms in the oil around the arc. Within the confines of this bubble, the liquid wall gives off insulating gases, while the arc current maintains an ionized conducting emission which stops each time the the current falls to zero. Heat and ion exchange phenomena occur within the turbulent gaseous mass, resulting in the eventual restoration of the dielectric strength of the medium.

At a given speed of separation of the contacts, the quality of the break depends on the effectiveness of the de-ionizing process. Research in this field has culminated in the development of arc-control chambers (also known as turbulence chambers).

The technique of arc-control chambers, first applied to the multipole single-tank circuit-breaker has led to the construction of single-pole circuit-breakers in separate tanks (1).

In the single-tank circuit-breaker, the oil ensures

- the extinction of arcs (de-ionizing fluid) and
- insulation both between phases and between phases and earth.

The relatively large volume of oil is required more for the second purpose (insulation) than for the first (extinction).

The single-tank unit is usually known as the "large oil-volume" type, although this volume depends on the type of unit and its breaking-capacity. For normal breaking-voltages and capacities, the volume of oil is about 30-40 litres. In some recent circuit-breakers, the casing and the tank are made of insulating material, and the amount of oil is very small (about 10 litres).

However, in their present form, these units cannot be used in gassy workings.

With the single-pole circuit-breaker, insulation between phases and between phases and earth is effected by solid insulators. Each tank contains the relatively small volume of oil (2-3 litres) necessary for extinction.

The separate tank unit is generally known as the "small-oil volume" type (2).

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(1) The break is said to be "free" if there is no arc-control chamber and "controlled" if the contrary is the case.

(2) In Germany the upper limit of "small oil-volume" units is 15 litres per unit.

2. Single-tank oil-circuit breaker (30-40 litres of oil)

The metal casing comprises an oil tank in which the contact section of the circuit-breaker and part of the control mechanism (lock) are immersed.

The moving part has a conducting arch for each phase, which makes or breaks the connection between a fixed "input" and "output".

The advantage of this arrangement is that the arc path lengthens at twice the speed of the movement of the arches.

As stated above, each arch path may be provided with an arc-control chamber made of pressure-resistant insulating material. Thus, when the circuit-breaker opens, the pressure is confined to the chambers, with no perceptible effect on the tank as a whole.

The single-tank oil circuit breaker is in widespread use. It has gained from improvements in circuit-breaking technique and from developments in control mechanisms; it is simple and robust.

The flameproof version of this circuit-breaker retains all its specific advantages.

N.B.: Firedamp protection of the single-tank circuit-breaker is ensured

- in some countries by the exclusive use of pressure-resistant casings,
- in other countries, by the extinguishing property of the oil (1)

The advantage of these designs is that the switch, the mechanism and the direct-protective relays are extremely solidly housed and are totally or partially oil-immersed.

With indirect electrical protection and supplementary operating, protection and control circuits, flameproof casings have to be used and part of the control mechanism loses the advantage of lub-ication.

3. The "small oil-volume" separate-tank circuit-breaker

As stated, this type has a tank of insulating material for each phase, forming an arc-control chamber containing the contacts, which are oil-immersed.

It is a single-contact switch, the contact being made by a moving rod and a fixed "tulip" contact connected to the circuit-breaker "input" and "output" respectively.

The break takes place in oil according to the process described in II.1. The speed of elongation of the arc is equal to that of the movement of the moving element.

The actuating mechanism, similar in principle to that of single-tank apparatus, is not incorporated in the switch. It is housed in a separate casing and operates the moving element via a cranked link-rod.

The electrical efficiency of this type of circuit-breaker is similar to that of the arc-control chamber single-tank variety, and it offers the same degree of protection and reliability.

Other things being equal, the overall dimensions of the separate tank circuit-breaker are not greater than those of the single-tank type.

In theory, the control mechanism (lock) is less well protected. But it is easily accessible, and can therefore be easily maintained and inspected.

Some older types may have seemed fragile and easily damaged, but nowadays they are simple and of robust construction.

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(1) This distinction emerged from tests carried out in the Netherlands. Experiments on a circuit-breaker showed that the unit remained flameproof irrespective of spaces between the joints provided sufficient extinguishing oil prevented ignition of the hydrocarbon/hydrogen mixture by the breaking arcs. Further, sub-committee 31 E of the International Electrotechnical Commission has drawn up a set of recommendations for the use of oil-immersed apparatus in an explosive atmosphere.

It might have been thought that the carbon released on arcing could pollute the oil, thus affecting the efficiency of the switch. Experience has shown these fears to be unfounded. The carbon collects at the bottom of the tanks, and can be removed by periodic drainage. Further, contrary to the theoretical possibilities with a single-tank circuit-breaker, the carbon cannot form conducting paths between phases.

The sealed construction has proved to be effective in dusty and damp surroundings.

In addition, the reduced volume of oil makes for greater fire protection.

The firedamp-proof construction does not affect the performance of the circuit-breaker.

In the German version, protection against firedamp is obtained by the simultaneous use of three methods of protection.

For the components which normally cause sparking:

"o" protection (1),(oil-filled casings i.e. oil-immersed) for the main circuit-breaker contacts;

"d" protection (2), (pressure-resistant, flameproof casings) for the auxiliary contacts and relays.

The remaining parts of the unit have "e" protection (3), as defined by a decision of the International Electrotechnical Commission. This Commission (sub-committee 31 C) is at present studying recommendations on this type of construction.

The results for the complete unit may be

- a saving in weight and cost over certain flameproof designs ("d" protection) (2);
- facilities for fitting additional operating, protection and control units and circuits.

III. BREAKING IN WATER - WATER-CIRCUIT BREAKERS

1. Breaking in water

This takes place according to the process known as the "low arc-resistance" process.

In a container filled with water (4), the arc current flows through a highly-ionized column of hydrogen; heat effect causes the liquid to heat and vaporize and to decompose into a mixture of hydrogen and oxygen.

Various devices employ increased pressure, expansion and turbulence to de-ionize the arc-gap and effect cooling.

As with oil-immersed units, the break takes place in pressure-resistant chambers.

On termination of the break, the moving element of the contact is out of the water, which is an extinguishing medium but not an insulator.

2. The water circuit-breaker

The circuit-breaker comprises arc tanks made of insulating, pressure-resistant material and mounted on supporting struts.

In its general layout, the unit is very similar to the "small oil-volume" separate-tank circuit-breaker.

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(1) "o" protection - Oelkapselung.
(2) "d" protection - druckfeste Kapselung.
(3) "e" protection - erhöhte Sicherheit (increased safety).
(4) i.e. water containing certain additives to prevent the fluid becoming more conductive.

The attraction of the water circuit-breaker lies in the use of a non-combustible extinguishing medium (1)

Firedamp-proof construction, which has been in use for many years in Germany but was introduced in France more recently, presents no difficulties. With the same advantages, it makes use of two of the methods of protection used in the "small oil-volume" unit (II.3)

IV. BREAKING IN A GASEOUS FLUID - INERT-GAS CIRCUIT-BREAKERS

1. Breaking in inert gas

a) There is a method of low arc-resistance circuit breaking whereby an active material releases a large volume of inert gas on being subjected to an arc. By suitable arrangement of the arc chambers, the gas, which is at first compressed, expands and extinguishes the arc.

This process has been the subject of experiment in various countries (1) and has been developed industrially in Germany.

b) A unit has recently become available in France in which the break takes place at low arc-resistance in sulphur hexafluoride (SF_6). This is a heavy, inert gas, and is an arc extinguisher. The arc chambers are arranged so that when the contacts separate, the gas is compressed and then blown on to the arc; and

an insulator. The gas, which is of high dielectric strength, insulates live components from one another and from the tank containing them.

2. Inert-gas circuit-breakers

a) This type of unit, which uses active material, is often known as a hard-gas circuit-breaker. It is similar in design to the separate-tank units described in II.3 and III.2.

The use of a non-inflammable gas in the arc gaps makes for greater fire protection.

In the firedamp-proof version, the unit made in Germany uses two of the methods of protection already described: pressure-resistant casings ("d" protection) and "increased safety" ("e" protection).

An advantage is that, when breaking a circuit, any firedamp in the arc gaps is diluted by a large volume of non-inflammable gas.

b) The sulphur hexafluoride unit is in the form of a parallelipipedic tank enclosing the arc chambers and part of the switch mechanism. The tank is sealed and filled with gas under pressure (3.3 atm. gauge).

The control mechanism (lock) is mounted on the front of the tank of which it forms an integral part.

The use of a non-inflammable gas for arc extinction makes for greater fire protection.

In the firedamp-proof version (of French manufacture), the entire circuit-breaker (tank and mechanism) is housed in a pressure-resistant casing ("d" protection).

The presence in the circuit-breaker tank of a gas under pressure prevents the entry of firedamp.

The circuit is therefore broken in a non-inflammable medium.

This important feature necessitates continuous checking of the gas pressure in the housing (and disconnection from the input side in the event of leakage).

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(1) In France, this system is frowned upon on account of the instability of the gas-producing material, which wears unevenly and sometimes very rapidly.

V. BREAKING IN AIR - AIRBREAK CIRCUIT-BREAKER

1. Breaking in air

a) Under this heading we may include the "low arc-resistance" breaking technique (I - 2b) whereby a jet of compressed air is injected as a contact opens, blowing out the arc.

- With the "air-blast" or "pneumatic" apparatus, the air is compressed by an auxiliary compressor.
- With the "self-compressing" type unit, the air is compressed by the switch itself as its opening movement commences.

b) Circuit-breaking in air, or "dry" circuit-breaking, normally signifies a high arc-resistance break, the principle of which was summarized in I - 2a.

- This method of circuit-breaking is normal for applications below 1,100 volts. Its use at higher voltages has been the object of research, in an attempt to achieve sufficient elongation of the arc within a comparatively restricted space. Improvements in magnetic blow-out techniques and especially in the design of arc chambers (of special refractory materials) have culminated in the achievement of this aim.

2. Airbreak circuit-breakers

a) Low arc-resistance breaking

1. The pneumatic circuit-breaker

This type of unit, generally used only for heavy-duty surface HT installations, has two disadvantages:

- it requires an auxiliary source of dry, clean compressed air;
- it causes significant voltage surges on opening.

The pneumatic circuit-breaker is sometimes used in fixed underground installations, but there is no firedamp-proof version.

2. The "self-compressing" circuit-breaker

The switching section of the unit is similar to that of inert-gas units (IV 2 a/b).

The single-pole arc chambers are arranged so that when the moving element opens, the air is compressed and is then blown on to the arcs.

For various reasons, in particular the low compression ratio of the blowing air, the breaking-capacity of the switch is always limited.

For moderate rated service currents, this defect is remedied by combining high-rupturing capacity fuses with the switch. These eliminate short-circuit currents.

(The fuses include a device which strikes the latch of the lock when they melt and causes the switch to open).

The rated service currents are controlled by relays which trip the mechanism in the event of overload.

The use of air as the arc-extinguishing medium and of "enclosed" fuse elements surrounded by inorganic materials makes for greater fire protection, but in this case particular attention must be paid to the possibility of the circuit being broken by shorts in circuit with high resistance.

In one firedamp-proof version made in Belgium the entire unit is housed in a pressure-resistant casing ("d" protection).

3. Combination of isolator and fuse

The combination of fuses with an isolator also makes it possible to provide short-circuit protection for those parts of the HT system which do not have to withstand overloads and to transmit heavy loads (e.g. small transformers whose secondaries supply lighting circuits or remote-control systems for staple-shaft winch motors).

In the firedamp-proof version, the fuses are mounted in a pressure-resistant casing. They may also be fitted on the moving pole pieces so that an arc can only occur inside the casing. In Germany, the remaining parts of the isolator are made to "e" protection.

This type of unit thus uses no inflammable extinguishing medium.

b) High-arc-resistance breaking

The air-break circuit-breaker (in the normal sense of the term)

The airbreak circuit-breaker is a multipole unit of American origin with various devices to extinguish the arc by elongation, splitting and cooling.

It is made for circuit-breaking capacities up to 500 MVA at 5 kV.

No servicing is required for this type of unit as regards the extinguishing medium: it is an effective rival to the conventional type of circuit-breaker.

In the firedamp-proof version, the unit, at present of multipole design, is enclosed in a pressure-resistant casing ("d" protection).

Difficulties arise, however, when it is used in an inflammable atmosphere:

1. General tests carried out in France have shown that the presence of firedamp in the enclosure may affect the quality of the break.

   The extent of this phenomenon is a little-understood function of various parameters (inflammable-gas content, operating voltage, power used).

2. Within certain limits of gas content, varying according to the design of the unit, persistence of the current and ignition upstream of the arc chambers have been observed. These phenomena, arising only at rated voltages above 3,000 volts, may be explained by a drop in dielectric strength within the enclosure; the flashover voltage between phases and between phases and earth is reduced and may cause general ignition.

   This problem is not insoluble. In France in particular, modifications to the equipment (layout, interposition of screens) can reduce the risk of ignition by lengthening the leakage paths; experiments with single-pole, flameproof, insulating arc chambers have given encouraging results as regards performance and space-saving.

VI. CONTACTORS

The usual function of a contactor is to switch on the starting current (1) and cut off the operating current of the circuit or equipment, which it governs.

The service of a contactor is determined by the number of switching operations it performs: if the rate of working is high, service is intensive.

In these circumstances, breaking in air is recommended, since repeated arcing in a dielectric such as oil quickly impairs its properties (decomposition, pollution with carbon).

We have already discussed the extinction of arcs in air (V 1.b). When this technique is applied to the contactor, difficulties arise from

- the service conditions (duty, damp atmosphere),
- intensive service in a confined airspace, resulting in ionization of the extinction chambers and the release of oxidizing gases (oxides of nitrogen and ozone).

(1) Starting current of a motor.

Ionization and oxidation impair the quality of the breaks and the operation of the contactor.

These difficulties may be an obstacle to the use of a contactor in an inflammable atmosphere. The remarks on this subject in the section on "dry" circuit-breakers (V.2) apply also to contactors.

The problem of circuit-breaking in air containing firedamp is the same for both circuit-breakers and contactors. The solutions at present being studied theoretically and experimentally are very similar in both cases.

VII. THE POSITION IN THE COMMUNITY COUNTRIES

GERMANY

The single-tank type unit is satisfactory if used within the limits of its breaking-capacity (for safety this is reduced to 75% of rated value, if the circuit-breaker is of firedamp-proof construction).

The rapid advance of mechanization with powerful machines has necessitated a considerable increase in short-circuit capacities.

For the corresponding breaking-capacities, the single-tank type unit takes up a great deal of space and contains a large volume of oil.

On the other hand, separate-tank single-pole circuit-breakers using a small volume of oil or water or inert gas guarantee the required breaking-capacity while maintaining acceptable dimensions. In German collieries, practically all new installations employ small oil-volume or oil-less circuit-breakers.

In firedamp-proof designs, industrial application of such units is facilitated by the use of "e" protection (increased safety), permitted in Germany for non-sparking components.

BELGIUM

The single-tank type unit (30-40 litres of oil) is everywhere considered satisfactory and has never caused accidents or incidents.

Administrative regulations require the firedamp-proof version to be enclosed in a pressure-resistant casing.

Water circuit-breakers are not yet authorized for workings where firedamp may accumulate.

Some collieries use pneumatic (air-blast) circuit-breakers at the air intakes.

A few airbreak circuit-breakers exist in firedamp-proof versions.

"E" protection is not yet authorized.

FRANCE

The single-tank type unit (30-40 litres of oil) gives satisfactory results (for intake airways, tests have been carried out with flue-gas absorbing devices).

In firedamp-proof versions, the various available types of single-tank units are rarely used.

Preference has generally been given to airbreak circuit-breakers, which are in process of rapid technical development.

A recently developed circuit-breaker uses "e" protection, although this is only allowed as an exception.

Finally, an inert-gas circuit-breaker using sulphur hexafluoride (SF_6) enclosed in a pressure-resistant housing has just been brought out.

ITALY

Units with pressure-resistant casings for voltages exceeding 1,100 volts are not used in coal-mines, where such voltages are not normally used.

NETHERLANDS

The single tank-type unit (30-40 litres of oil) has been in use for many years.

Experience in collieries has been entirely satisfactory.

The single-tank circuit-breaker (30-40 litres of oil) exists in a firedamp-proof version with a casing resistant to a given pressure under specified conditions of breaking-capacity and with a specified level of oil above the contacts.

"e" protection is not yet permitted in places where there is an explosion risk from a mixture of air and firedamp.

VIII. SUMMARY

A review of the techniques and types of circuit-breaking switchgear usable in atmosphere containing firedamp at voltages above 1,100 volts shows that at present the following equipment may be used:

1. Circuit-breakers

   Single- or separate-tank oil circuit-breakers

   a) water circuit-breakers,

   b) inert-gas circuit-breakers, which have existed in Germany in the hard-gas version for some time, and which have recently appeared in France in the sulphur hexafluoride design,

   c) airbreak circuit-breakers.

      In the latter case, application in gassy workings may raise certain problems which are being investigated.

      These circuit-breakers may be

      - of high arc-resistance,
      - of the "self-compressing" type combined with high breaking-capacity fuses. This combination requires particular attention to the breaking conditions for short-circuits in circuits with high resistance.

        For switchgear not subject to overloads, replacement of the circuit-breaker by an isolator also combined with fuses is sometimes sufficient.

2. With contactors, the same methods can theoretically be adopted, but it is difficult to avoid airbreak switching where intensive service is required.

   There is thus still a problem as regards their use in gassy workings. Research should be continued, since oil is still generally used in this case.

IX. CONCLUSION

Modern circuit-breaker technique for voltages above 1,100 volts is tending generally to reduce the volume of oil used or eliminate it altogether.

For this reason separate pole circuit-breakers of the oil-less or small oil-volume types are being progressively introduced in most countries, at least for new installations.

Tests with these circuit-breakers have demonstrated their excellent working safety in atmospheres containing firedamp.

However, tests on modern single-tank type circuit-breakers containing 30-40 litres of oil have also shown that this type of unit offers excellent protection in the presence of firedamp, with no particular danger of combustion if correctly chosen and installed.

For contactors for intensive service at voltages above 1,100 volts, it is impossible to eliminate the use of oil in flameproof designs.

x

x x

ANNEX IX

N O T E

on the problem of heat transmission in an insulated conductor
(by Monsieur COEUILLET, Charbonnages de France)

We start with a long cable (length l) the conductors in which have the initial temperature O_o and are satisfactorily insulated, so that there is no loss of heat (1). In such a simplified case the laws of heat transmission show that when one end of a cable is heated the temperatures occurring at the other end are too high.

Let us now assume that at the moment t = 0 the abscissa end x = 0 of the conductor is suddenly raised to temperature θ_1 and we seek to obtain the relationship:

$$\theta = f \quad (x, t)$$

from which we can determine the temperature of the conductor at a point M on the abscissa x, supposing that the transmission of heat is purely by conduction.

This is the classical problem of the "heat shock".

On grounds of symmetry the surfaces of equal warmth form rectilinear sections and the flow lines form straight lines.

In continuous operation the intensity of the heat flow (the amount of heat flowing through a unit of area) will correspond to the following formula in magnitude and sign:

$$q = -\lambda \frac{\delta \theta}{\delta x}$$

(λ = heat conductivity index).

For interrupted operation we shall take it that the speed of conduction of heat is proportional to the change in the heat flow between two points.

In one unit of section this speed of heat transmission is

$$C\omega \frac{\delta \theta}{\delta t}$$

where C is the specific heat and ω the specific weight.

This gives us:

$$C\omega \frac{\delta \theta}{\delta t} = - \frac{\delta q}{\delta x}$$

From which we obtain:

$$\boxed{\frac{\delta \theta}{\delta t} = a \frac{\delta^2 \theta}{\delta x^2}} \quad \text{with} \quad \boxed{a = \frac{\lambda}{C\omega}}$$ (a = heat conductivity index)

From integration we get:

$$\theta = \theta_o + (\theta_1 - \theta_o) \left(1 - \frac{2}{\sqrt{\pi}} \int_o^{\frac{x}{2\sqrt{at}}} e^{-\varphi^2} d\varphi\right) \qquad (1)$$

---

(1) This assumption is permissible, since the heat conductivity of copper is 1,000 to 2,000 times higher than that of normal insulating material (e.g. rubber).

The numerical values of the Gaussian integral can be found in all probability tables.

We substitute:

$$G = \frac{2}{\sqrt{\pi}} \int_{o}^{\frac{x}{2\sqrt{at}}} e^{-\varphi^2} \, d\varphi \qquad (2)$$

$$\theta = \theta_o + (\theta_1 - \theta_o) \; (1 - G)$$

Using formula (2) it is possible to calculate the temperature of the copper at every point and at any moment; in particular we obtain:

λ = 330 kcal/h/m ^oC

C = 0.1 kcal/kg ^oC

ω = 8,600 kg/m^3

and consequently:

a = 0.38 m^2/h ($\sqrt{a}$ = 0.62)

It should be noted that we should obtain for the insulated material a diffusion capacity 60 to 100 times weaker than is justified by the simplifications we have adopted.

1. First of all we calculate the ratio between x and t, which determines the beginning of heating:

   It is given by: $\theta = \theta_o$

   and consequently by: G = 1

   From this we can deduce:

$$\frac{x}{2\sqrt{at}} = 2$$

   or:

$$\boxed{\text{x is hardly distinguishable from } 2.5 \sqrt{t}} \qquad (3)$$

   where x is expressed in metres.

   As can be seen, the heat is transmitted relatively slowly since heating at a distance of 10 metres begins only after 16 hours.

   In practice the fire causing the heating would have damaged the cable very much earlier.

   In most pit fires therefore it is not the copper in the cable leads which act as a dangerous heat carrier.

2. Let us assume that at θ = 150^oC the insulating material is destroyed and the initial internal temperature of the cable conductors is at about 50^oC.

   Finally we suppose that the cable end is raised by the fire to θ_1 = 750^oC (order of magnitude of the maximum temperatures observed at Tremonia):

Formula (2) then runs:

$$G = \frac{\theta_1 - \theta}{\theta_1 - \theta_o} \tag{4}$$

and gives us:

$$G = \frac{600}{700} = 0.86$$

From this we can deduce: $\frac{x}{2\sqrt{at}}$ is hardly distinguishable from 1 (5)

and x is hardly distinguishable from $1.34\sqrt{t}$

It is therefore clear that more than 50 hours would be necessary to destroy the insulated material over a length of 10 metres.

The propagation of the heat by conduction in the copper consequently proceeds relatively slowly; even errors in the above calculations resulting from the inaccuracy of certain physical constants do not change anything in this fundamental statement.

The slowness of conduction of the heat is without doubt attributable to the fact that it is very difficult to raise the internal vibration energy of the crystals. It should moreover be remembered that in all metals the ratio between heat conductivity and electrical conductivity is relatively constant.

Viewed as a whole, the heating of the conductors in an electric cable can be said to constitute no danger of fire in practice if the heat source is external to the cable. The problem naturally changes if the heating of the conductor is due to the Joule effect.

x

x x

ANNEX X

E X P L A N A T O R Y   N O T E S

to the Recommendation on "Fixing of climatic limits" (1)

(Approved by the Mines Safety Commission at its Plenary Session of 18.7.1933)

(1) See Annex XI, page 411 of the present Report.

General

Before the Working Party began its actual work, it firstly prepared a survey of the appropriate regulations in the coal-producing countries of the Community and the indications contained in the specialist literature. The Working Party then took note of measures taken in some mine workings to cool the air at the working-points.

After this preliminary information work the Working Party examined the question on how working safety at hot working-points could be increased and the workers' health protected in the coal-producing countries of the Community.

It was agreed that these discussions should not start from the regulations in force in the Community countries, but from the objective facts which could provide criteria such as e.g. the medical observations and operational conditions obtaining at the moment.

The Working Party's view was that their discussions must start from the concept of "climate" and not from that of "temperature", since the latter is normally understood to mean the dry-bulb temperature.

As against this the concept of "climate" is more comprehensive and takes into account a series of factors of which the more important are: dry-bulb temperature, wet-bulb temperature, air velocity and radiation. This latter factor can however be left aside in coal-mining.

The Working-Party wanted to study the problems solely from the practical point of view. In several countries and in different branches of industry these problems have received detailed scientific investigation.

The results of these investigations are, it is true, not final, but they do allow of certain practical conclusions, subject to subsequent check.

There has been an increasing tendency in different countries to take special measures, in particular by reason of the increasing depth of working.

The Working Party unanimously agree that the issuing of a first series of practical measures could not wait until the final results of all the scientific investigations, some of them supported by the High Authority, were available.

The Working Party consisting of experts from the mining industries of Community countries decided to proceed carefully so that there should be no clash between the practical and scientific studies.

For this reason medical experts were co-opted. The Working Party were thus able to call upon the wide experience and comprehensive specialist knowledge of these experts, among whom were the delegates and rapporteurs of the "Research Committee for Industrial Health and Medicine" for work in high temperatures.

Once the Working Party had obtained a general view of the points requiring attention, an editorial committee was charged with formulating the individual points and bringing them together in a Recommendation.

The Draft proposed by the editorial committee was then discussed by the Working Party. The medical experts were also present during this discussion.

The result of this latter discussion in set out in the attached Recommendation, which is still very limited in its present form since it represents only a first step into a difficult and complicated field.

Naturally there are still a number of unanswered questions which can and must be solved. In dealing with these problems, medical experts will naturally be co-opted or consulted very readily.

It should be pointed out in this connection that the Working Party will see whether investigations could be recommended in which the doctors belonging to the "Research Committee for Industrial Health and Medicine" or the Working Party "Work in hot conditions" could collaborate.

Point 1: Measurement method

Once the Working Party had decided to start from the concept of "climate", this automatically raised the question of the method to be used to determine the climate and the manner in which the importance of the figures quoted in the Recommendation should be explained.

The difficulty of making a selection in this matter can be clearly shown by the fact that there are at present some 77 proposals for determination of climate. It should also be pointed out that each method has certain disadvantages and shortcomings. It should be said in this connection that the selection made naturally does not imply a judgment of the value of the method.

Each country is free to choose its own method provided that comparability of the basic data is assured.

It is therefore not envisaged that the method selected will be recommended for use in each country.

It was therefore decided to take the American effective temperature as a basis for the restricted objectives of the Working Party, and so long as there is no call for any changes to be made because of the introduction of a better physiological index of climate.

A note was taken of expert reports which made it clear that the American method is the best known. This is also true of the correction factors which must be applied to any given effective temperature.

It was moreover emphasized that the selected method had to be practical with an eye to the conditions obtaining underground. The American method fulfils this requirement.

Some members of the Working Party raised certain objections to the choice of the American effective temperature. Some of the objections to the American effective temperature concerned the investigations on which the method is said to be based. It was stated that the method was based on the investigation of men at rest and also on the concept of "feeling well". This was said to make it difficult to draw conclusions with regard to the application to men at work. In addition, the method was also said to be based on the concept of "transition comparison", which involves people who have moved from one set of conditions to another comparing their subjective reactions.

To these objections it was replied that a number of experts had not simply adopted the American nomograms and conclusions but had carried out numerous investigations on the subject, and had confirmed the values.

These investigations were said to be based not only on a short stay in hot surroundings, but also on a long stay. They had been carried out with men at rest as well as at work. In particular, investigations had been carried out in faces under continuous medical supervision and the various temperatures and humidity values had been measured. It was said that in these investigations a whole series of observations on the thermal equilibrium of the experimental persons had been made.

To make due allowance for a number of objections, it was decided to add Point 1.4:

"The investigations regarding the suitability and the correctness of the various climatic indices should be continued".

There are two nomograms for determining the American effective temperature, one for unclothed persons (basic scale) and the other for normally-clothed persons (normal scale).

Since the workers occupied in the climatic conditions in question do not wear much clothing, the first nomogram should be used. This is to be made clear by the addition of the words "basic scale".

Points 2 and 3: The two climatic limits

The problem which arises in working or remaining at hot working-points affects the maintenance of the thermal equilibrium of the men working or remaining at such points.

If the effective temperature reaches a given level, there is the risk that the workers cannot maintain equilibrium even at rest and a progressive rise in temperature thus takes place; in severe cases this could lead to collapse and consequently to severe damage to health. In these climatic conditions it is not sufficient to provide rest periods during the working time, since such periods can hardly assist the workers to recover their thermal equilibrium.

However, this equilibrium can be maintained from threshold lying below this maximum effective temperature if particular precautions depending on the degree of laboriousness of the work are taken, such precautions making it possible for the workmen to dissipate the excess of heat they have accumulated and, if appropriate, to reduce the energy they exert and thus reduce the excess of heat.

The Working Party decided on the basis of the above considerations to lay down as a matter of principle two limits for the effective temperature:

a) a threshold above which work, and even location at working-points must be forbidden for health and safety reasons (Point 2);

b) a lower limit, above which work can be carried out only provided particular measures are taken (Point 3).

The limit mentioned under a) can have very widely varying values according to whether the basis taken is purely scientific or is rather practical.

From a purely scientific point of view a performance of work at considerably higher temperatures may seem possible. Any provision based exclusively on these criteria will however hardly be of any practical value for the management, since the conditions under which work is carried out in very hot conditions cannot be made compatible with the requirements of work in a mine. Provisions of this kind would therefore have bad psychological effects.

In all hot working-points where men are permitted to work or to remain, the fundamental question arises as to whether it is better to reduce the working time of the men stationed there or to reduce the physical effort demanded of them.

From the scientific viewpoint the reduction of energy expenditure is undoubtedly the best. In practice however it is difficult to measure and to regulate the energy exerted at a hot working-point or indeed at any other working-point. This exertion of energy can moreover vary very widely among the individual men carrying out the same work.

The Working Party consider that limitation of the daily working time is an indirect but practical means of avoiding excessive energy expenditure and the dangers resulting therefrom in hot working-points. However, it is not sufficient simply to restrict working time. Consequently, an additional provision was made in an attempt to limit the energy expenditure of the men working in these climatic conditions.

Attention must also be drawn to the important task to be carried out by the responsible doctors. The medical inspections, periodical examinations and medical checks are naturally directed towards careful selection of the workers to avoid any danger to their health or any reduction of working safety.

In addition to this, the responsible Inspectorate can lay down a series of conditions, in connection with some of which the responsible doctors may be called in to advise. These measures also are intended to eliminate as far as possible any threat to the safety or health of the workmen.

Point 2: Fixing a maximum climatic value

As already pointed out, it may seem possible from a purely scientific point of view to work at relatively high temperatures. The Working Party was however primarily bound by the practical problems in the mining industry and had at the same time to take account of safety in work and protection of the workers' health.

The maximum value of 32° eff A (basic scale) named in Point 2 was deliberately chosen to allow a margin of safety. This point sets a scale for the permitted physiological load, which itself allows of a wide range of variation.

In two instances it is possible to make exceptions from the general ban on work or location in an effective temperature of more than 32° eff A (basic scale).

The first case in an exception which is foreseeable and for which written permission from the responsible Inspectorate is required (compare Points 2.3.1 to 2.3.3).

The other case is an exception by reason of great danger or special circumstances (compare Point 2.4). The responsible Inspectorate should be informed immediately (2.4.1), and the work is to be carried out as quickly as possible (2.4.2) under the conditions laid down in 2.3.1 to 2.3.4.

In the latter instance, the work envisaged is that which must at all costs be carried out immediately, without waiting for formal permission to be given.

Point 2.3.3 was deliberately formulated in this way to give the responsible Inspectorate the possibility of issuing regulations with regard to the duration of rest periods and the climate in which these periods were to be spent, separately for each individual case and allowing for the climatic range in which the work had to be carried out.

This must be done in each case in agreement with the responsible doctor.

The Working Party and the co-opted experts discussed at length the age limits of 40 and 45 years set out in Point 2.3.4. There was unanimity that men above 45 must be forbidden to work in these conditions. As medical statistics have shown, the incidence of heart and circulatory diseases rises in persons above 40 years of age. Consequently, such persons should preferably not be put to work at such working-points. In broad general terms persons above 40 years of age should not be set to work in such conditions. The view was that it would go too far to lay down a general ban on work, since the men in question were acclimatized and had previously undergone medical examination. The proposal to forbid workmen below 21 being put on such work was unanimously accepted.

Point 3: Climatic range between 32° eff A and 28° eff A (basic scale)

As already stated, it was decided to lay down another limit value - in addition to the maximum value - above which work could be carried out only provided certain precautionary steps were taken. There are therefore two limits laid down, an upper limit and a lower one. Since, as stated under 2, there is a general ban on work and location in these conditions above 32° eff A, it is logical that the upper level should be at 32° eff A.

The Working Party had a detailed discussion on the selection of the lower limit.

The medical representatives stated in this connection that the present state of knowledge did not permit of saying precisely beyond what limit damage to the workers' health must be expected to occur. The limit could be higher or lower and this held good even for selected and acclimatized persons. It was said that a further factor was whether the men had had a sufficient period of rest between two shifts, and what they had done in that intervening period.

Investigations had shown that the performance of acclimatized workers in large stonedrifts dropped off by 20 % at 28° eff A. The explanation of this might be that the men reduced their performance to avoid damage to their health.

It also had to be borne in mind in this connection that the workmen in the Community countries generally work up to pensionable age, and that this is not true in certain non-European countries.

Apart from the medical aspect, the safety aspect also influenced the determination of this limit. The Working Party agreed unanimously that the limit must be fixed in such a way that the safety of the workmen was not interfered with.

It was therefore necessary to provide as large a safety margin as possible so as to ensure that any such bad effects on safety were eliminated.

In the light of the foregoing considerations it was decided to fix this limit at 28° eff A (basic scale).

This gave the definition of a climatic range in which special precautions had to be taken for the men employed on work there.

These are either measures which refer to the entire climatic range or measures which apply to given sections of the climatic range, namely for the sections 30 to 32° eff A (basic scale) and 28 to 30° eff A (basic scale).

In the case of the entire climatic range, what applies is that the men to be employed there have to undergo a suitable medical inspection beforehand and can only be set to work in that climatic range when they have been medically passed to do so.

Special attention must be given to several points in carrying out this medical examination.

In addition persons who are continually employed in this climatic range must undergo medical examination at regular intervals, at least once a year.

Point 3.1.3 contains particular provisions for the duration of stay in the climatic range above 30° eff A up to 32° eff A (basic scale) or in the range above 28° eff A up to 30° eff A (basic scale).

In addition to restricting the duration of stay, which may have an effect on the length of working time of the workers in these climatic ranges, point 3.1.4 contains a special provision regarding the method of payment to be applied. Among other things, this provision calls for a method of payment adjusted to the working conditions. The purpose of this provision is to limit the expenditure of physical energy by the workmen.

It was originally intended to introduce a ban on piecework or on man-and-mate arrangements. However, by reason of the fact that the work of the Working Party "Effective Methods of Payment on Safety" had not progressed far enough to reach conclusions, it was considered premature to introduce bans of this kind.

In fixing the shift time, the limitation of the duration of stay to 5 (or 6 hours) - as provided in Point 3.1.3 - must be borne in mind.

In practice, the shift time is reduced in several Community countries for men who work under the same or similar conditions. Apart from the restriction of the expenditure of energy, the purpose of this measure to give these workmen the possibility of moving into normal climatic conditions earlier and for longer periods than others, so that they may get up their strength again and avoid any damage to their health.

To allow the responsible Inspectorates to take the necessary measures in good time, it was provided in Point 3.1.2 that they must be informed in writing as soon as the effective temperature at a working-point exceeds 28^{o} eff A (basic scale).

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ANNEX XI

R E C O M M E N D A T I O N

on "Fixing of Climatic Limits" (1)

(Approved by the Mines Safety Commission
at its Plenary Session 18.7.1963)

(1) See Annex X, page 403 of the present Report.

1. BASIC PRINCIPLES

1.1 As long as the introduction of a better physiological index of climate does not appear to make a change necessary, the basis taken will be the American effective temperature ^{o} eff A (basic scale). This is an integrated climatic value derived from dry-bulb temperature ($^{o}C_{t}$), wet-bulb temperature ($^{o}C_{f}$) and air velocity (m/s).

However, any air velocities over 3 m/s should be treated as though only 3 m/s in determining the American effective temperature.

1.2 In so far as individual countries have other temperature regulations, temperature should be indicated in such a way that a comparison is possible on the basis indicated in para 1.1, without the present Recommendation calling for a standardized measurement method.

1.3 The legal or wages tariff provisions covering temperature which are in force in the individual countries were not used by the responsible body as the starting point for determination of climatic limits, and they used only medical and mining factors.

The climatic limits established in this way should however be considered as maximum values in the individual countries. Better climatic values for the workers in the individual countries remain unaffected.

1.4 Further investigations into the suitability and correctness of the various climatic indices are to be carried out.

2. ESTABLISHMENT OF AN UPPER CLIMATIC VALUE

2.1 Medical observations have shown that unfavourable climatic values can lead to permanent damage to health and to ill-considered actions on the part of the worker, resulting in threats to his own safety and to the safety of his work-mates.

An upper climatic limit is laid down to avoid this state of affairs.

2.2 It is forbidden to work or to remain at working points when the temperature is above 32^{o} eff A (basic scale) except in the cases mentioned in paras. 2.3 and 2.4.

2.3 An exception can be made to the ban on working and remaining in temperatures above 32^{o} eff A (basic scale) if the responsible Inspectorate has given permission and the workers in question have been medically examined beforehand.

The following conditions must then be fulfilled:

2.3.1 The responsible Inspectorate may give the working permit only for a stated time and for stated working operations.

2.3.2 The work must be carried out under medical supervision. Guiding lines should be drawn up for this medical supervision and for the examination mentioned under 2.3, with the co-operation of medical experts.

2.3.3 Work must not be carried out for longer than one hour without a break. A rest period of suitable length in better climatic conditions should then be arranged.

The duration of uninterrupted working time and the duration and frequency of the rest periods, together with the climatic conditions in which the latter are spent, and all other necessary regulations, should be laid down individually in writing by the Inspectorate in association with the responsible doctor before work begins.

2.3.4 Acclimatized persons should be selected. No one above 40 years of age should be put on this work. Persons below 21 or above 45 of age should not be employed.

2.4 A further exception can be made to the ban on working or remaining in temperatures above 32° eff A (basic scale) if danger threatens or special circumstances arise which require immediate intervention.

In this case, however:

2.4.1 The responsible Inspectorate and the responsible doctor must be immediately informed,

2.4.2 The work must be carried out as quickly as possible under the conditions laid out in 2.3.1 to 2.3.4.

3. CLIMATIC RANGE BETWEEN 32° eff A and 28° eff A (basic scale)

3.1 For climatic conditions directly under the maximum limit set out in paragraph 2.2, there is laid down a range in which work must be subject to certain precautionary measures.

These special precautions represent an intermediate stage between work in normal circumstances and the ban on work or staying at points where the upper limit has been exceeded.

The following requirements apply to the climatic range between 32° eff A and 28° eff A (basic scale):

3.1.1 In this climatic range, the only persons who may be employed are those who have been found suitable after medical examination.

This examination must pay particular attention to the heart and the circulatory system.

Men who are permanently employed in this climatic range should be examined medically once a year.

In addition the following requirements apply:

3.1.2 As soon as the working-point reaches a temperature exceeding 28° eff A (basic scale), the responsible Inspectorate should be informed in writing on each occasion.

3.1.3 The duration of stay in the climatic range between 30° eff A and 32° eff A (basic scale) is restricted to 5 hours, and the climatic range from 28° eff A to 32° eff A (basic scale) to 6 hours.

3.1.4 In order to avoid any physical overloading, the system of payment employed in respect of work in the climatic range between 28° eff A and 32° eff A (basic scale) should be one suitable for these conditions.

3.1.5 The requirements set out in paragraphs 3.1.3 to 3.1.4 apply to all persons who in any one shift have to work for more than half the duration of that shift in one of the climatic ranges listed.

ANNEX XII

R E P O R T

on the psychological and sociological factors affecting safety (1)

(Approved by the Mines Safety Commission at its Plenary Session of the 14 and 15.2.1966)

(1) See Annex XIII, page 425 of the present Report.

CHAPTER I

MEASURES WHICH MAKE IT POSSIBLE FOR THE WORKMEN TO RECOGNIZE THE DANGERS AND TO CARRY OUT THEIR WORK IN SUCH A WAY THAT THESE DANGERS ARE AVOIDED

CHAPTER II

TRAINING THE MANAGEMENT AND SUPERVISORY OFFICIALS IN RESPECT OF SAFETY PROBLEMS

CHAPTER III

SUITABILITY OF PSYCHO-TECHNICAL EXAMINATION

General remarks

Two prerequisite conditions are necessary to ensure working safety:

- as far as possible the working-place must be free of risk;
- the manner in which the work is carried out and behaviour during this work must be such as to avoid any dangers which might exist in spite of the precautions taken at the working-place in line with the principles set out above.

To this end it is necessary:

a) to study beforehand - as far as possible - all dangers which can arise when working in the particular conditions obtaining; this preliminary investigation is the only thing which makes it possible to check in good time all the precautions to be taken by those responsible for the organization of work;

b) to bring to the notice of all persons who might be threatened by such dangers during their work the dangers which might possibly arise from the working conditions obtaining;

c) to instruct the workmen in the manner in which the work is to be carried out so that these dangers can be avoided without their causing risk to themselves or to their workmates;

d) to ensure that the work is in fact carried out in accordance with the instructions given.

All these precautions should create a safety "atmosphere" and should contribute to convincing those concerned that a concern for productivity is compatible with efforts to ensure safety.

I.- MEASURES WHICH MAKE IT POSSIBLE FOR THE WORKMEN TO RECOGNIZE THE DANGERS AND TO CARRY OUT THEIR WORK IN SUCH A WAY THAT THESE DANGERS ARE AVOIDED

A.- Recognizing the dangers

This task is the responsibility of the mineowners, the management officials and the supervisory officials (1).

1. Before starting work in a district, a section of the working or a working point (2) and before any planned major change in the manpower deployment or in working conditions, it is essential to check all the safety precautions; before work is begun, each district, each section of a working or working-point should be covered by an investigation of the safety precautions to be taken; this does not apply only to the collective large-scale precautions - which in practice belong in the working regulations - but also covers the individual precautions for safety of work; this investigation into the safety conditions is an essential complement to the investigation of the technical and economic conditions of the work which is being planned.

2. During the work, there should be continuous supervision of the safety conditions.

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(1) The definition of the concepts "management official" and "supervisory official" differs from one country to another. To understand the text which follows and to apply the Recommendations attached as an Annex, it should be taken that management and supervisory officials cover at least all those who do not take part in the execution of the work but are responsible to supervise the activities and behaviour of the other workmen in this work, and who have the right, if required, to take sanctions in the event of contravention of the instructions issued.

(2) These concepts are taken to cover a working unit which forms an entity and is covered by instructions from one responsible official with respect to mine safety.

Regular reports should be prepared on

a) changes in working conditions,
b) accidents or other incidents,
c) dangerous situations encountered during work.

The data thus collected in these reports should be systematically assessed so that - with full knowledge of the circumstances - it should be possible to draw statistical conclusions and the maximum amount of useful information for the preparation of recommended precautions for similar cases.

3. On the basis of the information assembled in this manner during work in a district, a section of a working or a working-point it is advisable, once the work is concluded, to prepare a report of experience showing the winning system applied, the dangers which arose and the measures taken to eliminate them, as well as the accidents, incidents and dangerous situations which arose during this work.

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Some members held the view that this record should include a comparison of the results in respect of safety for the district, section of a working or working-point in question with the economic results obtained (e.g. output, o.m.s., costs).

Without making the preparation of this record a general rule, other members would prefer the comparison between the safety and economic aspects to be made as often as the enterprise is in a position to do so, but on condition that the comparison should not lead to subordinating the safety aspect to that of economics.

B.- Making known the dangers to all concerned

Before starting work in a district, a section of a working or a working-point or in the event of a major change in the operating conditions, it is desirable - after previous investigation of any dangers which may arise and the precautions to be taken - to arrange a discussion between representatives of the management, the officials and members of the safety service as well as the workers concerned or their representatives, in order to inform each individual with regard to the position, to discuss the work in detail and to settle upon the most suitable method of work for these operations. This method of work should be announced to the workers concerned by the best means available for the purpose.

During the execution of the work, the management or the officials should refer to the regulations and instructions to be observed as often as necessary, to guard against the danger of over-familiarity.

If observations made during the work show it to be necessary to issue new safety instructions, these should be brought to the notice of every worker concerned.

It is also advisable to ensure that reports made by each of the workmen regarding dangerous situations which arise during the work should be brought to the notice of the management officials. These reports are not only essential for the investigation of the safety precautions which have to be taken immediately, but also because they make it possible for the management officials to draw general conclusion for practical operations, and above all serve for the preparation of the report of experience (see section A.3).

C.- Instruction in the manner in which the work is to be carried out without danger

Preliminary remarks

This is essentially vocational training.

From this point of view the Conference on Safety in Coalmines had already issued a series of Recommendations which have been accepted by all the Governments.

These Recommendations refer both to the objectives of vocational training and to the conditions under which the training must be carried out.

Their implementation represents a major contribution to realizing the objective which the Working Party have set itself.

1. Every underground worker must have:
   - a general training as an underground worker;
   - a special training for the work to which he is to be assigned;
   - the necessary supplementary training to cover the special working conditions at the point where he will work.

2. This training will only achieve its objective if the workman actually carries out the work for which he was trained under the conditions envisaged, and that he does in fact continue this work under the same conditions, or - should there be a change in the work or in the working conditions - he has had the necessary supplementary training.

3. Instruction in safety precautions is to be considered as a part of vocational training. This training in respect of safety should serve, among other things, to convince the personnel that observance of safety regulations and concern with productivity are completely compatible.

4. The persons entrusted with this training must be numerous enough and must have available the necessary means and time to carry out their task correctly.

D.- Supervision of the manner in which the work is carried out in respect of safety

The supervision, not only of production, but also of the observance of safety regulations is the responsibility of the management and supervisory officials.

Emphasis must be laid on their complete responsibility in this connection.

In addition to this supervision, it seems necessary to take further measures which are particularly intended to ensure that the manner in which the work is carried out meets the safety requirements.

These other measures should simultaneously be checked with the other means which have to be used, to ensure that everyone concerned is taking a proper part in the efforts to achieve a maximum level of safety.

II.- TRAINING THE MANAGEMENT AND SUPERVISORY OFFICIALS IN RESPECT OF SAFETY PROBLEMS

Preliminary remarks

1. To ensure the necessary training of the officials and to guarantee that they carry out their task in detail as it has been made known to them, it is advisable to take steps to ensure that the officials do not change post frequently.

2. The supervision, which must be exercised with authority, should in its everyday action seek to perfect the training and education of the workmen on the basis of daily experience, and should give rise to fines or penalties only in very serious cases.

3. The officials must understand clearly that they are fully responsible for the execution and supervision of the work. Nothing can take away from this responsibility, not even any safety service which may be in existence or the presence of self-protection assistants.

4. There are various ways in which men can reach the post of official. Workers can rise to this position from practical operations, e.g. young workers after a minimum period of practical work and after attending technical school. Others can also take on the responsibilities of officials, after the termination of a vocational or technical training course - even perhaps at a higher level.

There are special factors to be borne in mind in the training of these different groups of persons; thus, in particular, for officials who have "risen from the ranks" and who normally have an extensive practical knowledge of working methods, the main emphasis should be placed on imparting a theoretical and a general level of education.

It is equally appropriate to distinguish several stages in the hierarchy of the officials - management and supervisory - and to suit the vocational training to the special requirements of each of these stages. The transition from one stage to another should be possible for a given person only once he has actually proved to have the required knowledge and skill.

A.- Basic principles for vocational training of management officials and supervisory officials

1. The principles laid down in chapter 1 for the workers also apply to the management and supervisory officials. These latter must be given a general education corresponding to the special features of their tasks and responsibilities, and in particular an adequate knowledge of the safety regulations, of the safety precautions to be taken and the available safety equipment and its use.

2. They must in addition have an adequate knowledge of the special instructions to the different vocational groups whose work they called upon to supervise, and the special instructions for the exercise of these activities at the working-points for which they are responsible.

3. The management officials and supervisory officials must also be able to point out in a suitable way to the workers under their orders the dangers associated with their work, and to instruct them as to how best to carry out the work in order to avoid these dangers.

4. They should also be trained in how to issue instructions in practice.

5. Special attention must be paid to the further training of all management and supervisory officials, so that their state of training is always maintained at a level appropriate to the development of the technical processes in use, the operating conditions and working safety.

6. They must finally not only justify the execution of their responsibilities and report thereon, but also give reports on accidents and all other notable incidents which have occurred during the working period at the points for which they are responsible.

   With respect to accidents, this calls for the following information:

   - correct presentation of the reports,
   - the assessment of the data in these reports,
   - the establishment of the causes,
   - the proposal of means to avoid such accidents.

B.- <u>Training the staff responsible for preparing the accident reports; the form sheets to be used for this purpose</u>

1. To make it possible to work out suitable measures to avoid the repetition of such accidents the accident reports must give all the necessary information, taking into account all the appropriate human and technical factors, and in particular:

   - the circumstances,
   - the consequences of the accident,
   - the causes
   - the precautions proposed to avoid similar accidents.

2. Each of these items of information must be capable of formulation as an answer to a clear and precise question.

3. The breakdown and layout of the form used for such a report must indicate clearly what the answers from each of the personnel should cover in respect of the preparation of the accident report. In addition, there must be sufficient room for supplementary remarks or sketches, which should be added if appropriate.

4. It is advisable that each of these workers should be informed of the importance of each question and of the manner in which correct answers should be given. This information must make it possible for him to characterize clearly the causes of the different accidents according to the classification on which the report is based. It is advisable to draw their attention to the consequences of failure to answer or inaccuracy in answering.

5. Systematic attention should be paid to ensure that the answers are complete, careful, and precise.

6. It is advisable to give a guarantee to the officials charged with the preparation of these reports that the reports are used for no other purpose than the prevention of accidents.

7. These reports are to be used as a basis for the regular preparation of reports and experience for each district, section of a working or working-point (see above 1-A-2). They can also serve as the basis for a series of suitable measures to stir up a spirit of competitivity and to achieve the co-operation of all those concerned to increase working safety.

C.- <u>Nomination and promotion of management officials and supervisory personnel</u>

It is indispensable for the achievement of genuine safety in underground work that there should be a sufficient number of supervisory personnel with the appropriate skills for the technical problems and for those of safety, combined with a complete understanding of their responsibility in these two fields; it is equally essential to have management officials who meet the same standards. The responsibility for the selection of these officials is considered by some members of the Working Party to fall primarily on the employer; other members of the Working Party hold the view that the employer is the sole responsible person.

To ensure a selection which promises good results, the minimum requirements for promotion to one of these posts or promotion within one of these fields of activity should be laid down beforehand, and these appointments or promotions must be subject to the production of satisfactory reports.

In various countries certain methods are in use, which allow the responsible Inspectorate actually to check the knowledge and skill of any candidate for a supervisory post, a management officials' post or for promotion within one of these fields - both from the human and vocational points of view - so as to make sure that the knowledge and skill of the candidate fulfils the requirements of the posts in question.

In some countries proposals for appointment and promotion must, under current regulations, previously be submitted to the responsible Inspectorate, with an indication of the supervisory responsibilities and the field in which they are to be exercised. The final appointment to the post can be made only with the agreement of the responsible Inspectorate.

In other countries, all that is done is to inform the responsible Inspectorate beforehand, with an adequate degree of information about the responsibilities of the person under consideration and the field in which these responsibilities are to be exercised. This makes it possible for the Inspectorate to check whether the candidate has the required qualifications. The fact that they are informed in this way enables the Inspectorate to raise objections which may prevent the appointment being made.

In some countries the employer has a completely free hand in the selection of his staff and the responsible Inspectorate intervenes only if there is neglect in the application of the safety precautions.

Without coming down in favour of one or the other of these methods, minimum requirements should be laid down for a process by which the responsible Inspectorate can check - both from the human and from the vocational points of view - the knowledge and skills of all the supervisory or management officials, either when appointments or promotions are being made, or subsequently if there has been a case of failure.

III.- SUITABILITY OF PSYCHO-TECHNICAL EXAMINATION

Psycho-technical examinations are a useful technique which, when used together with other information (e.g. from medical examinations and reports on the vocational skills of the candidate), are suitable for providing the management or their representatives with the best information on the basis of which to make their decisions regarding the placing of a worker, his assignment to particular special work or his promotion to a supervisory post.

A.- At the moment of assigning a man to a post, the relatively simple psycho-technical examination is intended to help in the determination of the general intellectual level of the candidate, so that those who fall below a certain minimum level in this respect can be excluded.

1. Practical observations have shown the exceptional danger of accidents which arise from the employment underground of persons whose intellectual level is below this limit, since the incidence of accidents is much higher than the average in this category. Without wishing to make use of a psycho-technical examination before each assignment and in every case, it is, however, consequently advisable to use these psycho-technical examinations as far as possible.

2. Psycho-technical examination prior to the assignment is an examination for selection, the sole purpose of which is to determine whether the candidate has sufficient skills to exercise a particular activity immediately or after some lapse of time.

3. In view of the constantly-increasing complexity of mining activities, it would be advantageous to carry out this selection prior to assignment with an eye to the exercise of a particular activity.

B.- 1. It is essential that workers who are intended to be used on particular working operations which involve a special degree of responsibility with regard to collective safety or which call for a particular level of intellect or personality, should in every instance be subjected to a special psycho-technical examination which can show wether they possess the characteristics required for the exercise of this activity.

2. The responsible Inspectorate should precisely define - in association with the representatives of the employers and of the employees and as soon as possible - the work for which these special examinations are to be prescribed. To this end, there should be prepared and kept up to date a list of those working operations in connection with which it has been shown by experience that it is particularly valuable to prescribe such examinations, and that it is possible to carry them out in practice.

   This applies, e.g. to:

   - locomotive drivers,
   - onsetters,
   - winding enginemen,
   - foremen shotfirers or shotfirers,
   - haulage supervisors,
   - supervisory officials,

C.- 1. Workers who are intended for promotion to supervisory posts must be subjected to suitable psycho-technical examination.

2. The psycho-technical examinations which are carried out in connection with assignment to particular work or to promotion to supervisory posts should as far as possible cover the vocational specialization of the workers concerned, i.e. the test should contribute to determining the activities for which the worker is best suited by reason of his capabilities.

D.- Basic principles for carrying out the various examinations mentioned above

1. The management must lay down the criteria which must be met by the candidate on assignment or on subsequent re-assignment.

   In the case of particular occupations, the psychologist should also be in a position to establish these criteria in the light of experience based on the examination of workers who have carried on these occupations for a certain period of time.

2. The psychologist must have an adequate knowledge of the activities carried out by the candidate and the conditions in which these activities are performed.

3. The psychologist's assessment is valid for a limited period only.

4. It is necessary to have regular reports from the direct superiors of the workers who have already been subjected to psycho-technical examination, and these continuing reports should be compared with the earlier psychologist's assessments.

5. It is essential that the preparation and presentation of these records should be organized systematically, to achieve a sufficient degree of objectivity and a valid comparison with the psychologist's assessment.

   Care should be paid to ensuring that the regular assessments take into account all the factors which characterize the vocational behaviour of a worker, whereas the psychological assessment is based on only a restricted number of specific factors.

   The regular assessments can therefore not simply be restricted to a summary, general assessment of the vocational behaviour of each worker. They must in particular contain answers to a certain number of particular questions regarding the vocational behaviour of the person being examined.

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ANNEX XIII

R E C O M M E N D A T I O N

on the psychological and sociological factors affecting safety (1)

(Approved by the Mines Safety Commission at its Plenary Session of 14th and 15th/2/66)

(1) See Annex XII, Page 415, of the present Report.

1. <u>Measures which make it possible for the workmen to recognize the dangers and to carry out their work in such a way that these dangers are avoided</u>

1.1 <u>Recognizing the dangers</u>

1.1.1 Before starting work in a district, a section of a working or a working-point and before any planned major change in the manpower deployment or in working conditions, it is essential to check all the safety precautions.

1.1.2 During the work, regular reports must be prepared on the basis of the safety conditions which have to be observed under continuous supervision, on the following points:

a) Changes in operating conditions,
b) Accidents or incidents,
c) Dangerous situations encountered during work.

The data brought together in these reports must be systematically assessed, with a view to improving or adapting the safety precautions in force. After the work has been finished, the data assembled on the basis of experience should be used to prepare a report of experience which should at least include information regarding the winning method used, the dangers which arose and the precautions taken to deal therewith, together with the accidents, incidents and dangerous situations which occurred during the working operations.

1.2 <u>Making known the dangers to all concerned</u>

1.2.1 Before starting work in a district, a section of a working or a working-point or in the event of a major change in the operating conditions, it is desirable to arrange a discussion between representatives of the management, the officials and members of the safety service as well as the workers concerned all their representatives, in order:

- to inform each individual with regard to the work envisaged;
- to discuss in detail the work to be carried out;
- to settle upon the method of work.

1.2.2 The workers concerned should be informed of the method of work chosen.

1.2.3 During the execution of the work, the management or the official should refer to the regulations and instructions to be observed as often as necessary.

1.2.4 If it is necessary to issue new safety instructions, these should be brought to the notice of every worker concerned.

1.2.5 Reports made by each of the workmen regarding dangerous situations which arise during the work should be brought to the notice of the management officials.

1.3 <u>Instruction in the manner in which the work is to be carried out without danger</u>

1.3.1 Every worker assigned to underground work must be able to show that he has:

- a general training as an underground worker;
- a special training for the work to which he is to be assigned;
- the necessary supplementary training to cover the special working conditions at the point where he will work.

1.3.2 Should there be a change in the work or in the working conditions, the necessary supplementary training must be provided.

1.3.3 Instruction in safety precautions is to be considered as a part of vocational training.

1.4 Supervision of the manner in which the work is carried out in respect of safety

1.4.1 During the work the safety conditions must be subject to continual supervision.

1.4.2 The duty to see that safety regulations are observed, and the responsibilities resulting from this duty, fall upon the management and supervisory officials.

1.4.3 The supervision, which must be exercised with authority, should in its every-day action seek to perfect the training and education of the workmen on the basis of daily experience, and should give rise to fines or penalties only in very serious or repeated cases of infringement.

2. Training the management and supervisory officials in respect of safety problems

2.1 General

2.1.1 Steps must be taken to ensure that the officials do not change posts frequently.

2.1.2 The vocational training should be adapted to the particular features of the official's task and his responsibility, and in particular, to the requirements of his place in the hierarchy of management officials and supervisory personnel.

2.1.3 The transition from one stage to another should be possible for a given person only once he has actually proved to have the required knowledge and skill.

2.2 Basic principles for vocational training and management and supervisory officials

2.2.1 The management officials and supervisory personnel must have an adequate knowledge of:

- the safety regulations,
- the safety precautions to be taken,
- the available safety equipment and its use,
- special instructions in force for the different vocational groups whose work they are called upon to supervise, and the special instructions for the exercise of these activities at the working-points for which they are responsible.

2.2.2 The management officials and supervisory officials must be able:

- to point out in a suitable way to the workers under their orders the dangers associated with their work;

- to instruct these workers as to how best to carry out the work in order to avoid these dangers.

2.2.3 The management and supervisory officials should be trained in how to issue instructions in practice.

2.2.4 Special attention must be paid to the further training of all management and supervisory officials.

2.2.5 The management officials and supervisory personnel must both

- account for the execution of their work and report thereon,
- and report on all accidents and other notable incidents which have occurred during the working period at the points for which they are responsible.

2.2.6 The management staff and supervisory personnel must be able:

- to present accident reports correctly;
- to assess the data in these reports;
- to establish the causes of the accidents;
- to propose means to avoid such accidents. They must receive the training necessary to this end.

2.3 <u>Staff responsible for training</u>

2.3.1 The staff responsible for the training activities set out on paras 1.3 and 2 must be numerous enough and must have available the necessary means and time to carry out their task correctly.

2.4 <u>Preparation of the accident report; training the staff responsible for filling in these reports</u>

2.4.1 The accident report must give all necessary information, taking into account all the appropriate human and technical factors, in particular:

- the circumstances
- the consequences of the accident
- the causes
- the precautions proposed to avoid similar accidents.

2.4.2 Each of these items and information listed under point 2.3.1 must be capable of formulation as an answer to a clear and precise question.

2.4.3 The breakdown and layout of the form used for the accident reports must clearly show which questions have to be answered by each of the personnel contributing to the preparation of the reports.

2.4.4 There must be sufficient room on the form for supplementary remarks or sketches.

2.4.5 Each of the workers contributing to the preparation of the report must be informed with regard to:

- the importance of each question,
- the importance of correct answers to the questions.

2.4.6 Instructions based on practical examples should be used to draw the attention of these employees to the consequences of neglectful, thoughtless or unclear answers to the questions.

2.4.7 Systematic attention should be paid to ensure that the answers are complete, careful and precise.

2.4.8 The accident reports referred to in the foregoing chapter are used only for the prevention of accidents.

2.5 <u>Appointment and promotion of management officials and supervisory personnel</u>

2.5.1 Care should be taken to ensure that there is available an adequate number of management and supervisory officials possessed of the requisite skills both in the technical and safety fields.

2.5.2 The selection of these officials is the responsibility of the employer, who must at least inform the responsible Inspectorate of the persons entrusted with supervision of working operations, together with the necessary data justifying the selection.

2.5.3 To ensure a selection which promises success, there should be laid down the minimum requirements for appointment to a post in one of these categories, either by direct appointment or by promotion, together with the certificates etc. on which this appointment depends.

2.5.4 The responsible Inspectorate should be in a position to check the knowledge and skills of the management and supervisory officials - both from the human and specialist points of view - should the Inspectorate consider it necessary, at least in the case of a major failure or of repeated failures.

3. Utility of psycho-technical examinations

3.1 On assignment

3.1.1 It is recommended that the application of a relatively simple psycho-technical examination upon assignment should be developed as far as possible, in order to:

- determine the general intellectual level of the candidate;
- to exclude those candidates whose intellectual level lies below a pre-determined minimum.

3.2 Before the exercise of specific activity

3.2.1 In every instance the workmen who are made responsible for the execution of particular working operations

- with which there is associated a particular responsibility in respect of collective safety or
- which call for particular intellectual or personality characteristics

should be subjected to a special psycho-technical examination to determine whether they have the capacities required for this activity.

3.2.2 The responsible Inspectorate must, in collaboration with the representatives of the employers and employees, keep up to date the list of work for which these special examinations are to be prescribed and to this end should list the functions which have been shown by experience to call for such tests and for which such tests can in practice be carried out.

3.3 Before any promotion of a worker to the post of an official

3.3.1 Before the promotion of any workman to the post of an official a suitable psycho-technical examination should be carried out.

3.4 Principles underlying the various psycho-technical examination

3.4.1 The psycho-technical examinations listed under 3.2 and 3.3 should as far as possible aid the vocational specialization of the worker in question.

3.4.2 The management must lay down the criteria which have to be met by the candidate on assignment or later when directed to special tasks, and should be advised by psychologists when so doing.

3.4.3 The psychologists' assessment should be valid only for a restricted period and must be compared with the assessments of the vocational behaviour of the person in question.

x
x x

ANNEX XIV

DECISION (1)
OF 9TH JULY, 1957
CONCERNING THE TERMS OF REFERENCE AND RULES OF PROCEDURE OF THE MINES SAFETY COMMISSION

(1) See "Journal officiel de la Communauté européenne du charbon et de l'acier" no. 28 of the 31st August 1957.

DECISION

of 9th July, 1957

concerning the terms of reference and rules of procedure of the mines safety commission

Having taken note of the Recommendations adopted by the Conference on Safety in Coalmines and of the proposals submitted by the High Authority in connection with the Conference's final Report, which afford a working basis for the improvement of safety in coalmines, and

having regard to their Decisions at the Council's 36th and 42nd sessions on September 6, and May 10, 1957, setting up the Mines Safety Commission,

THE REPRESENTATIVES OF THE GOVERNMENTS OF THE MEMBER STATES MEETING AT THE SPECIAL COUNCIL OF MINISTERS,

- hereby lay down that the terms of reference of the aforesaid Commission shall be as follows:

1. The Commission shall follow developments regarding safety in coalmines, including those regarding the safety regulations instituted by the public authorities, and assemble the necessary information concerning progress and practical results obtained, more especially in the matter of accident prevention.

   To secure the necessary information, the Commission shall apply to the Governments concerned.

   The Commission shall evaluate the information in its possession and submit to the Governments proposals for the improvement of safety in coalmines.

2. The Commission shall help the High Authority to work out a method of compiling intercomparable accident statistics.

3. The Commission shall ensure the prompt forwarding to the quarters directly concerned (including in particular mines inspectorates and employers' and workers' associations) of relevant information assembled by it.

4. The Commission shall ascertain, by regular contact with the Governments. what action is being taken to implement the proposals of the Conference on Safety in Coalmines, and such proposals as it may itself draw up.

5. The Commission shall propose such study and research as it deems most indicated for the improvement of safety, with notes as to the way in which these can best be effected.

6. The Commission shall facilitate the exchange of information and experience among persons responsible for safety matters, and propose appropriate measures for this purpose (e.g. organization of study sessions, establishment of documentation services).

7. The Commission shall propose appropriate measures for ensuring the necessary liaison among the rescue services of the Community countries.

8. The Commission shall submit annually to the Council of Ministers and the High Authority a Report on its activities and on developments regarding safety in coalmines in the different member States. In this connection, it shall in particular examine the statistics compiled on accidents and incidents in coalmines.

- The Representatives of the Governments further lay down that the rules of procedure of the Commission shall be those set forth in the Annex to the present Decision.
- The Representatives of the Governments trust that the High Authority will arrange for the Commission to start work at the earliest possible moment.

This Decision was adopted by the Council at its forty-fourth session, on July 9, 1957.

For the Council,

(sgd.) J. REY
President.

(ANNEX)

Rules of procedure

of the Mines Safety Commission

CHAIRMAN

Article 1

The Chairman of the Mines Safety Commission shall be a Member of the High Authority of the European Coal and Steel Community.

Article 2

The Chairman shall conduct the work of the Commission in accordance with these Rules of Procedure.

MEMBERS

Article 3

The Commission shall consist of 24 members appointed by the Governments; each country shall have four members, of whom two shall be representatives of that country's Governments, one of the employers and one of the workers.

Each Government shall send in writing to the Chairman a nominal roll of the members appointed by it. It shall notify the Chairman of all changes in this.

Each Government may appoint for any particular meeting of the Commission one or two advisers, whose names it shall send to the Chairman.

I.L.O. PARTICIPATION

Article 4

Representatives of the International Labour Organization shall be invited to attend the proceedings of the Commission in a consultative capacity.

U.K. PARTICIPATION

Article 5

Delegates appointed by the Government of the United Kingdom may attend the proceedings of the Commission as observers.

ORGANIZATION

(a) Restricted Committee

Article 6

A Restricted Committee shall be set up, to consist of Governments' representatives on the Commission.

Article 7

The Chairman of the Commission shall act as Chairman of the Restricted Committee.

Article 8

The function of the Restricted Committee shall be to ensure permanent liaison among the Governments of the member States and between them and the Commission, more especially for the purpose of exchanging relevant information. The Restricted Committee shall see to the preparation of the Commission's activities.

Article 9

The Restricted Committee shall be convened by the Chairman.

The Chairman shall be required to convene it when asked to do so by the representatives of three or more Governments.

(b) Working Parties

Article 10

The Commission of the Restricted Committee may set up working parties of experts to consider specific technical matters.

Article 11

The working parties shall decide their own modus operandi.

Article 12

The Restricted Committee shall be given reports by the working parties on the results of their proceedings, which it shall submit to the Commission with the comments of its members.

In the event of differences of opinion within the working parties, the views expressed shall be given, together with the names of those expressing them.

SECRETARIAT

Article 13

The High Authority shall be responsible for the secretarial arrangements in connection with the work of the Commission, the Restricted Committee and the working parties.

These arrangements shall be under the charge of a High Authority staff member appointed to act as Secretary.

All documents shall be in the four official languages of the Community.

WORKING PROCEDURE

Article 14

The Chairman shall fix the agenda and the dates of meetings after consultation with the members of the Restricted Committee.

Article 15

The Chairman shall allow to speak any member of the Commission, representative of the International Labour Organization or United Kingdom observer asking to do so.

The Chairman may allow advisers to speak.

Article 16

The members of the High Authority shall have the right to attend meetings of the Commission and of the Restricted Committee, and to speak there.

The Chairman may bring with him advisers, whom he may allow to speak.

Article 17

Where the Commission or the Restricted Committee deems it desirable to obtain information concerning the various aspects of safety in coalmines, it shall request this from the Governments of the member States.

Article 18

Sixteen members shall constitute a quorum. Conclusions shall be adopted by majority of the members present.

Proposals by the Commission under 1,3 of its terms of reference shall, however, require a vote in favour by two-thirds of the members present, and by not less than thirteen members in all.

Any dissenting opinions shall be brought to the attention of the Governments should the members expressing them so request.

x

x x

ANNEX XV

DECISION (1)

OF 11TH MARCH, 1965

OF THE REPRESENTATIVES OF THE GOVERNMENTS

OF THE MEMBER STATES ASSEMBLED IN THE SPECIAL

COUNCIL OF MINISTERS TO MODIFY THE DECISION

OF 9TH JULY 1957

CONCERNING THE TERMS OF REFERENCE AND RULES

OF PROCEDURE OF THE MINES SAFETY COMMISSION

(1) See "Journal officiel de la Communauté européenne du charbon et de l'acier" no. 46 of 22nd March 1965.

DECISION

of 11th March, 1965

of the Representatives of the Governments
of the Member States assembled in the Special
Council of Ministers to modify the decision
of 9th July 1957
concerning the terms of reference and rules
of procedure of the Mines Safety Commission

THE REPRESENTATIVES OF THE GOVERNMENTS OF THE MEMBER STATES ASSEMBLED IN THE SPECIAL COUNCIL OF MINISTERS -

having regard to the decision of 9th July 1957 regarding the terms of reference and rules of procedure of the Mines Safety Commission, and

having regard to the High Authority's proposal of 7th January 1964, and

seeing that this decision in no way affects Article 118 of the Treaty setting up the European Economic Community -

DECIDE:

Article 1

The terms of reference of the Mines Safety Commission laid down by the decision of 9th July 1957 are replaced by the provisions in the annex.

Article 2

The provisions of Article 17 of the rules of procedure annexed to the Decision of 9th July 1957 are replaced by the following provisions:

"Should the Mines Safety Commission or the Restricted Committee consider it desirable to receive information regarding the various fields for which it is responsible, it shall apply to the Governments of the member States."

This decision was adopted by the Council at its one-hundredth session, on 11th March 1965.

For the Council

(sgd.) M. Maurice-Bokanowski

President

(ANNEX)

Terms of reference for the Mines Safety Commission

1. The Commission shall follow developments regarding safety and measures to avoid at working-points conditions which represent a danger to health in coalmines, including to this end the safety regulations instituted by the public authorities and assemble the necessary information concerning progress and practical results obtained.

   To secure the necessary information, the Commission shall apply to the Governments concerned.

   The Commission shall evaluate the information in its possession and submit to the Governments proposals for the improvement of safety and healthy conditions in coalmines.

2. The Commission shall help the High Authority to work out a method of compiling intercomparable statistics on accidents and damage to health attributable to vocational activities in coalmines.

3. The Commission shall ensure the prompt forwarding to the quarters directly concerned (including in particular mines inspectorates and employers' and workers' associations) of relevant information assembled by it.

4. The Commission shall ascertain, by regular contact with the Governments, what action is being taken to implement the proposals of the Conference on Safety in Coalmines, and such proposals as it may itself draw up.

5. The Commission shall propose such study and research as it deems most indicated for the improvement of safety, and of healthy working conditions in coalmines, with notes as to the way in which these can be effected.

6. The Commission shall facilitate the exchange of information and experience among persons responsible for safety matters and the maintenance of healthy working conditions, and propose appropriate measures for this purpose (e.g. organization of study sessions, establishment of documentation services).

7. The Commission shall propose appropriate measures for ensuring the necessary liaison among the rescue services of the Community countries.

8. The Commission shall submit annually to the Council of Ministers and the High Authority a Report on its activities and on developments regarding safety and protection of health in coalmines in the different member States. In this connection, it shall in particular examine the statistics compiled in these fields.

ANNEX XVI

Composition of the Safety Commission,
the Working Parties and Sub-Committees,
and their meetings

Situation 1966

ANNEX XVI

CONTENTS

A.- MINES SAFETY COMMISSION

a) Composition

FEDERAL REPUBLIC OF GERMANY

Government representatives

Regierungsdirektor W. SCHNASE, Referat III A 1, Bundesministerium für Wirtschaft, 5300 Bonn,

Ministerialdirigent Dr.-Ing. K. HELLER, Ministerium für Wirtschaft, Mittelstand und Verkehr des Landes Nordrhein-Westfalen, 4 Düsseldorf, Haroldstr. 4

Employers' representatives

Dr.-Ing. F. BENTHAUS, Bergassessor a.D., Steinkohlenbergbauverein, 43 Essen, Friedrichstr. 2

Workers' representatives

E. STEBEL, Leiter des Sachgebietes Arbeitsschutz, IG-Bergbau und Energie, 4630 Bochum, Alte Hattingerstr. 19

Technical advisers

Ministerialrat W. LATTEN, Ministerium für Wirtschaft, Mittelstand und Verkehr des Landes Nordrhein-Westfalen, 4 Düsseldorf, Haroldstr. 4

Oberbergamtsdirektor K. HÜBNER, Leiter der Unterabteilung Montanwirtschaft, Ministerium für Wirtschaft, Verkehr und Landwirtschaft, 6600 Saarbrücken, Hardenbergstr. 8

BELGIUM

Gouvernment representatives

A. VANDENHEUVEL, Directeur général des mines, Ministère des affaires économiques, 6-8, rue de la Science, Bruxelles

G. LOGELAIN, Inspecteur général des mines, Ministère des affaires économiques, 6-8, rue de la Science, Bruxelles

Employers' representatives

A. HAUSMAN, Directeur du Coördinatiecentrum Reddingswezen van het Kempische Steenkolenbekken, Kempische Steenweg 555, Kiewit - Hasselt

Workers' representatives

L. THOMAS, Secrétaire national de la Centrale syndicale des travailleurs des usines de Belgique, 16, impasse Pirnay, Grace-Berleur

Technical advisers

L. BOULET, Directeur général du Fonds national de retraite des ouvriers mineurs, Ministère du travail et de la prévoyance sociale, 6, place Stéphanie, Bruxelles

M. THOMASSEN, Président national de la Centrale des francs-mineurs, 145, rue Belliard, Bruxelles

FRANCE

Government representatives

J. N. PROUST, Ingénieur en chef des mines, Ministère de l'industrie, 97, rue de Grenelle, Paris 7e

A. REBIERE, Ingénieur en chef, chef du Service de l'hygiène et de la sécurité dans les mines, Direction des mines, Ministère de l'industrie, 97, rue de Grenelle, Paris 7e

Employers' representatives

N. BERNARD, Directeur général des services techniques et sociaux des Charbonnages de France, 9, avenue Percier, Paris 8e

Workers' representatives

L. CHAUVEAU, Fédération nationale des syndicats chrétiens des mineurs, 8, rue de Navarre, Paris 5e

Technical advisers

J. POREBSKI, 247, bd. de la Victoire, Annequin (Pas-de-Calais)

ITALY

Government representatives

Dott. Consigliere B. COLUCCI, Direzione generale dell'emigrazione, Ministero degli affari esteri, Roma

Ing. Giovanni GIROLAMI, Ispettore generale delle miniere, Ministero dell'industria e commercio, via Veneto 33, Roma

Employers' representatives

Prof. M. CARTA, Istituto arte mineraria, Piazza d'Armi, Cagliari (Sardegna)

Workers' representatives

Dott. G. CRAVIOTTO, Segretario generale della Libera federazione italiana lavoratori industrie estrattiva, via Isonzo 42, Roma

Technical advisers

Dott. C. MICHELAZZI, Ispettore generale del Ministero del lavoro e della previdenza sociale, via Flavia 6, Roma

LUXEMBOURG

Government representatives

A. SCHUSTER, Ingénieur-directeur du travail et des mines, Inspection du travail et des mines, 19, av. Gaston Diderich, Luxembourg

Employers' representatives

A. RAUS, Directeur à l'A.R.B.E.D., Luxembourg

Workers' representatives

N. PASCOLINI, Président de la délégation ouvrière d'Arbed-Mines, 90, rue des Fleurs, Schifflange

NETHERLANDS

Government representatives

Ir. A.H.W. MARTENS, Inspecteur-generaal der Mijnen, Staatstoezicht op de Mijnen, Apollolaan 9, Heerlen (L.)

Drs. D.C. VAN DER HOOFT, Hoofd van de Directie Mijnwezen, Ministerie van Economische Zaken, Bezuidenhoutseweg 30, 's-Gravenhage

Employers' representatives

Ir. G.B. DEBETS, Directeur, Oranje-Nassau Mijnen, Heerlen (L.)

Workers' representatives

J. PALMEN, Secretaris van de Nederlandse Katholieke Mijnwerkersbond, Schinkelstraat 13, Heerlen (L.)

Technical advisers

H.L. GROND, Katholieke Vereniging van Mijnbeambten, Schelsberg 202, Heerlerheide (L.)

UNITED KINGDOM

Government representatives

A.M. RAKE, C.B.E., Under-Secretary, Safety and Health Division of the Ministry of Power, 7 Millbank, Thames House South, London S.W. 1

H.S. STEPHENSON, Chief Inspector of Mines, Ministry of Power, 7 Millbank, Thames House, London S.W. 1

Employers' representatives

Dr. H.L. WILLET, Deputy Director-General of Production, National Coal Board, Hobart House, Grosvenor Place, London S.W.1

Workers' representatives

S. BULLOUGH, Vice-President of the National Union of Mineworkers, c/o Miners' Offices, Barnsley / Yorkshire

INTERNATIONAL LABOUR ORGANIZATION, GENEVA

- A representative of the International Labour Office as an observer.

b) Sessions of the Mines Safety Commission

1. 23rd June 1961
2. 12th December 1961
3. 26th March 1962
4. 27th November 1962
5. 18th and 19th July 1963
6. 11th October 1963
7. 27th and 28th April 1964
8. 16th October 1964
9. 11th December 1964
10. 19th and 20th July 1965
11. 14th and 15th February 1966
12. 5th and 6th May 1966

B.- RESTRICTED COMMITTEE

a) Composition

The Restricted Committee consists of the Government representatives on The Mines Safety Committee.

b) Sessions of the Restricted Committee

1.	30th May 1961
2.	30th November 1961
3.	2nd March 1962
4.	26th March 1962
5.	30th October 1962
6.	26th November 1962
7.	27th and 28th May 1963
8.	11th July 1963
9.	10th and 11th September 1963
10.	18th November 1963
11.	14th April 1964
12.	2nd October 1964
13.	15th October 1964
14.	10th December 1964
15.	5th and 6th July 1965
16.	24th January 1966
17.	25th April 1966

C.- WORKING PARTIES ON TECHNICAL PROBLEMS

I. Working Party on "Electricity"

a) Composition

GERMANY

Oberbergamtsdirektor G. EPPING, Oberbergamt, 4600 Dortmund, Goebenstr. 25-27

BELGIUM

G. LOGELAIN (1), Inspecteur général des mines, Ministère des affaires économiques, 6-8, rue de la Science, Bruxelles

R. STENUIT, Directeur divisionnaire à l'Administration des mines, 6-8, rue de la Science, Bruxelles

G.J.A. COOLS, Directeur divisionnaire à l'Administration des mines, 6-8, rue de la Science, Bruxelles

H. GOBBE, Chef de service à la division câblerie des A.C.E.C., Charleroi

FRANCE

R. CŒUILLET, Ingénieur en chef au service exploitation des Charbonnages de France, 9, avenue Percier, Paris 8e

P. FLINOIS, Houillères du Bassin du Nord et du Pas-de-Calais, Service technique du fond, 20, rue des Minimes, Douai/Nord

M. OSTY, Directeur technique à la Société industrielle de liaisons électriques, 64bis, rue de Monceau, Paris 8e

F. VIN, Ingénieur au CERCHAR, Verneuil-en-Halatte (Oise)

Y. EYRAUD, Chef du laboratoire d'études générales des Câbles de Lyon, 170, avenue Jean-Jaurès, Lyon (Rhône)

ITALY

Dott. Ing. L.VENTRELLA, Direttore dell'Istituto italiano del marchio di qualità per i materiali e le apparecchiature elettrotecniche, via Misurata 61, Milano

LUXEMBOURG

E. MÜLLER, Ingénieur des mines à l'Administration des mines luxembourgeoises de l'A.R.B.E.D., Esch-sur-Alzette

---

(1) As representative of the Restricted Committee.

NETHERLANDS

Ir. E.A.R. HOEFNAGELS, Inspecteur der Mijnen, Staatstoezicht op de Mijnen, Apollolaan 9, Heerlen (L.)

Ir. W.P.A.J. KEMPEN, Elektrotechnisch Adviseur van de Mijnbedrijven, p/a Staatsmijn Emma, Hoensbroek

Ir. F. GOEDBLOED, Nederlandse Kabelfabriek, Delft

Ir. W.L. BAER, N.V. Hollandse Draad- en Kabelfabriek, Amsterdam

UNITED KINGDOM

D.E. FOX, H.M. Principal Electrical Inspector of Mines and Quarries, Thames House, South Millbank, London S.W. 1

b) Sessions of the Working Party on "Electrification" and its sub-committee

1.	16th January 1961
2.	17th January 1961
3.	21st February 1961
4.	28th February 1961
5.	29th March 1961
6.	12th May 1961
7.	21st September 1961
8.	15th November 1961 (Charleroi)
9.	24th January 1962
10.	24th May 1962
11.	19th July 1962
12.	20th, 21st and 22nd September 1962 (Milan)
13.	18th December 1962
14.	28th January 1963
15.	30th April 1963
16.	19th June 1963 (Liège-Herstal)
17.	19th and 20th September 1963 (Essen and Heerlen)
18.	21st November 1963
19.	9th January 1964
20.	30th and 31st January 1964 (Verneuil)
21.	21st February 1964
22.	5th March 1964
23.	10th September 1964
24.	7th January 1965
25.	11th March 1965
26.	4th and 5th May 1965 (Buxton and Newcastle)
27.	1st October 1965
28.	16th December 1965
29.	17th February 1966
30.	21st April 1966
31.	8th June 1966

II. Working Party on "Mine fires and heatings"

a) Composition

GERMANY

Ministerialrat W. LATTEN (1), Ministerium für Wirtschaft, Mittelstand und Verkehr, Land Nordrhein-Westfalen, 4000 Düsseldorf, Haroldstr. 4

Dipl. Ing. E. BREDENBRUCH, Leiter der Hauptstelle für das Grubenrettungswesen des Steinkohlenbergbauvereins, 4300 Essen-Kray, Schönscheidtstr. 28

Dipl. Ing. A. SCHEWE, Technischer Leiter der Hauptstelle für das Grubenrettungswesen des Steinkohlenbergbauvereins, 4300 Essen-Kray, Schönscheidtstr. 28

BELGIUM

A. VANDENHEUVEL, Directeur général des mines, Ministère des affaires économiques, 6-8, rue de la Science, Bruxelles

G. LOGELAIN, Inspecteur général des mines, Ministère des affaires économiques, 6-8, rue de la Science, Bruxelles

R. STENUIT, Directeur divisionnaire à l'Administration des mines, 6-8, rue de la Science, Bruxelles

FRANCE

G. CHAMPAGNAC, Directeur aux houillères du bassin de Lorraine, Merlebach (Moselle)

J. CRETIN, Ingénieur divisionnaire, poste central de secours Belle-Roche, Merlebach (Moselle)

H. MORIN, Ingénieur en chef, chef des services généraux du fond aux houillères des Cévennes, Alès (Gard)

LUXEMBOURG

A. SCHUSTER, Directeur de l'Inspection du travail et des mines, 19, avenue Gaston Diderich, Luxembourg

M. LEINEWEBER, Contrôleur au service de l'Inspection du travail et des mines, 108a, rue du Stade, Niedercorn

ITALY

Ing. V. BUSONERO, Direttore miniera, società Carbosarda, Carbonia (Cagliari)

Dott. Ing. A. PELLATI, via E. Gianturco 1, Roma

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(1) As representative of the Restricted Committee.

NETHERLANDS

Ir. D.J. KNUTTEL, hoofdinspecteur der mijnen, Staatstoezicht op de Mijnen, Apollolaan 9, Heerlen (L.)

Prof. Dr. W. MAAS, chef van de Veiligheidsdienst der Staatsmijnen in Limburg, van der Maesenstraat 2, Heerlen (L.)

UNITED KINGDOM

R. BELL, National Coal Board, Production department, Hobart House, Grosvenor place, London S.W. 1

b) Sessions of the Working Party on "Mine fires and heatings" (Jointly with the Working Party on "Rescue organization")

1.	29th June 1961	
2.	7th December 1961	
3.	28th February and 1st March 1962	(Hauptstelle für das Grubenrettungswesen, Essen-Kray)
4.	13th April 1962	
5.	29th May 1962 (Jointly with the Directors of the Research Stations)	
6.	18th December 1962	
7.	19th April 1963	
8.	21st May 1963 (Coördinatiecentrum Reddingswezen, Hasselt)	
9.	28th October 1963	
10.	10th December 1963	
11.	13th July 1964	
12.	19th November 1964	
13.	20th May 1965	
14.	16th September 1965	

1a) Sub-Committee on "Practical problems with shaft fires at great depth"

GERMANY

Dipl. Ing. K. GRUMBRECHT, Abteilungsleiter, Versuchsgrubengesellschaft mbH, 4600 Dortmund, Tremoniastr. 13

Dipl. Ing. A. SCHEWE (Präsident/président), Technischer Leiter der Hauptstelle für das Grubenrettungswesen des Steinkohlenbergbauvereins, 4300 Essen-Kray, Schönscheidtstr. 28

BELGIUM

L. DE CONINCK, directeur du Centre national belge de coordination des centrales de sauvetage, 17, rue Puissant, Charleroi

A. HAUSMAN, directeur du Coördinatiecentrum Reddingswezen, 555, Kempische Steenweg, Hasselt

R. STENUIT, directeur divisionnaire à l'Administration des mines, 6-8, rue de la Science, Bruxelles

FRANCE

J. CRETIN, ingénieur divisionnaire, poste central de secours Belle-Roche, Merlebach (Moselle)

NETHERLANDS

Ir. D.J. KNUTTEL, hoofdinspecteur der mijnen, Staatstoezicht op de Mijnen, Apollolaan 9, Heerlen (L.)

1b) Sessions of the Sub-Committee

1.	20th June 1962
2.	10th July 1962
3.	18th July 1962
4.	28th August 1962

2a) Sub-Committee on "Theoretical problems with shaft fires at great depth"

GERMANY

Dr.-Ing. K. RENNER, Forschungsstelle für Grubenbewetterung, 4300 Essen-Kray, Dortmunderstr. 151

Dr.-Ing. W. SCHMIDT, Prüfstelle für Grubenbewetterung, 4630 Bochum, Hernerstr. 45

Dipl. Ing. A. SCHEWE, Technischer Leiter der Hauptstelle für das Grubenrettungswesen des Steinkohlenbergbauvereins, 4300 Essen-Kray, Schönscheidtstr. 28

BELGIUM

R. STENUIT (Präsident/président), directeur divisionnaire à l'Administration des mines, 6-8, rue de la Science, Bruxelles

J. BRACKE, ingénieur principal divisionnaire, Institut national des mines, 60, rue Grande, Pâturages

J. PATIGNY, ingénieur divisionnaire, Institut d'hygiène des mines, Havermarkt, Hasselt

H. CALLUT, directeur et ingénieur en chef à l'Institut national des mines, 60, rue Grande, Pâturages

FRANCE

R. LOISON, directeur au CERCHAR, 35, rue Saint-Dominique, Paris 7e

J. CRETIN, ingénieur divisionnaire, poste central de secours, Belle-Roche, Merlebach (Moselle)

NETHERLANDS

Dr. W. DE BRAAF, directeur van het Centraal Proefstation der Staatsmijnen, Treebeek (L.)

Prof. Dr. W. MAAS, chef van de Veiligheidsdienst der Staatsmijnen in Limburg, van der Maesenstraat 2, Heerlen

UNITED KINGDOM

Dr. H.S. EISNER, Ministry of Power, Safety in Mines Research Establishment, Harpur Hill, Buxton (Derbyshire)

2b) Sessions of the Sub-Committees

1.	5th September 1962
2.	14th November 1962
3.	28th November 1962
4.	13th January 1966

2c) Joint sessions of the two Sub-Committees

1.	10th January 1964 (Versuchsgrube in Dortmund)
2.	5th February 1964
3.	19th February 1964 (Versuchsgrube in Dortmund)
4.	4th March 1964 (Verschusgrube in Dortmund)
5.	7th April 1964 (Versuchsgrube in Dortmund)
6.	24th April 1964 (Versuchsgrube in Dortmund)
7.	1st and 2nd February 1965
8.	9th March 1965
9.	26th March 1965
10.	13th April 1965
11.	30th April 1965
12.	1st June 1965

3a) Sub-Committee on "Opening-up of fire zones"

GERMANY

Dipl. Ing. A. SCHEWE, Technischer Leiter der Hauptstelle für das Grubenrettungswesen des Steinkohlenbergbauvereins, 4300 Essen-Kray, Schönscheidtstr. 28

Dipl. Ing. K. GRUMBRECHT, Abteilungsleiter, Versuchsgrubengesellschaft mbH, 4600 Dortmund, Tremoniastr. 13

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BELGIUM

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A. HAUSMAN, directeur du Centre de coordination des moyens de sauvetage de Campine, 555, Kempische Steenweg, Hasselt

FRANCE

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R. GRISARD, ingénieur des mines, Charbonnages de France, 9, avenue Percier, Paris 8e

UNITED KINGDOM

W.A. WOOD, Director of Safety, National Coal Board, Hobart House, Grosvenor Place, London S.W. 1

3b) Sessions of the Sub-Committee

1. 7th February 1964
2. 16th March 1964
3. 11th June 1964

4a) Group of experts on "Fire-resistant fluids"

GERMANY

Dipl. Ing. E. BREDENBRUCH (Präsident/président), Leiter der Hauptstelle für das Grubenrettungswesen des Steinkohlenbergbauvereins, 4300 Essen-Kray, Schönscheidtstr. 28

Dr. chem. H.W. THOENES, Hauptabteilungsleiter, Technischer Überwachungsverein e.V., 4300 Essen, Steubenstr. 53

Dipl. Ing. K. GRUMBRECHT, Abteilungsleiter, Versuchsgrubengesellschaft mbH, 4600 Dortmund, Tremoniastr. 13

Prof. Dr. med. MALORNY, Direktor des Pharmakologischen Instituts der Universität Hamburg, 2000 Hamburg

Dr. med. habil. PRIMAVESI, Oberarzt, Hygiene-Institut des Ruhrgebietes, 4650 Gelsenkirchen, Rotthauserstr. 19

Dr. med. BENTHE, Dozent, Pharmakologisches Institut der Universität Hamburg, 2000 Hamburg

Dr. phil. H. ZIMMERMANN, Hygiene-Institut des Ruhrgebietes, 4650 Gelsenkirchen, Rotthauserstr. 19

BELGIUM

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G.A. NENQUIN, ingénieur divisionnaire, Institut national des mines, 60, rue Grande, Pâturages

J. BRACKE, ingénieur principal divisionnaire, Institut national des mines, 60, rue Grande, Pâturages

Docteur J. CRISPOUX, 2, rue Potresse, Wasmes

FRANCE

R. LEFEVRE, ingénieur des mines, 3, rue Louis Rolland, Montrouge (Seine)

G. BLANPAIN, ingénieur au Centre d'études et recherches des Charbonnages de France, Verneuil-en-Halatte (Oise)

Docteur J.J. JARRY, médecin-chef des Charbonnages de France, 9, avenue Percier, Paris 8e

Docteur C. CLAEYS, Centre d'études médicales minières, Centre Faivre d'Arcier, Sin-le-Noble (Nord)

NETHERLANDS

H. ITALIE, Arts, inspecteur der mijnen, Staatstoezicht der Mijnen, Apollolaan 9, Heerlen (L.)

4b) Sessions of the Sub-Committee

1.	23rd February 1961
2.	21st April 1961
3.	21st June 1961
4.	17th July 1961
5.	25th September 1961 (Institut National des Mines, Pâturages)
6.	26th September 1961 (Technischer Ueberwachungverein, Essen)
7.	5th and 6th December 1961 (Laboratoire des Lubrifiants, Sin-le-Noble)
8.	22nd December 1961 (Institut National des Mines, Pâturages)
9.	5th July 1962
10.	23rd August 1962
11.	17th September 1962
12.	6th December 1962
13.	8th and 9th January 1963
14.	12th and 13th February 1963
15.	27th February 1963
16.	7th and 8th March 1963
17.	26th April 1963
18.	10th June 1963
19.	16th and 17th July 1963
20.	6th and 7th August 1963 (Versuchsgrubengesellschaft m.b.H., Dortmund)
21.	3rd and 4th September 1963
22.	17th and 18th October 1963 (Pharmalologisches Institut, Hamburg)
23.	22nd October 1963 (Versuchsgrubengesellschaft m.b.H., Dortmund)
24.	5th and 6th December 1963
25.	24th and 25th February 1964
26.	29th and 30th April 1964
27.	6th May 1964 (Laboratoire des Lubrifiants, Sin-le-Noble)
28.	22nd May 1964 (Institut National des Mines, Pâturages)

29.	2nd June 1964 (Versuchsgrubengesellschaft m.b.H., Dortmund)
30.	1st July 1964
31.	11th November 1964
32.	15th and 16th February 1965 (Versuchsgrubengesellschaft, m.b.H., Dortmund)
33.	31st March 1965
34.	1st April 1965 (Institut National des Mines, Pâturages)
35.	30th April 1965 (Versuchsgrubengesellschaft, m.b.H., Dortmund)
36.	17th September 1965
37.	25th and 26th November 1965
38.	27th January 1966
39.	24th February 1966
40.	28th March 1966
41.	1st June 1966

5a) Sub-Committee "Mine ventilation"

GERMANY

Dipl. Berging. W. BOTH, Hauptstelle für das Grubenrettungswesen des Steinkohlenbergbauvereins, 4300 Essen-Kray, Schönscheidtstr. 28

Dr. rer. nat. W. SCHMIDT, Prüfstelle für Grubenbewetterung, 4630 Bochum, Hernerstr. 45

Dr.-Ing. R. GREUER, Forschungsstelle für Grubenbewetterung, 4300 Essen-Kray, Dortmunderstr. 151

BELGIUM

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J. PATIGNY, ingénieur divisionnaire, Institut d'hygiène des mines, Havermarkt, Hasselt

FRANCE

G. CHAMPAGNAC (Präsident/président), directeur aux houillères du bassin de Lorraine, direction des études et des travaux neufs, Merlebach (Moselle)

J. CRETIN, ingénieur divisionnaire, poste central de secours, Belle-Roche, Merlebach (Moselle)

E. SIMODE, ingénieur divisionnaire, houillères du bassin de Lorraine, direction des études et des travaux neufs, Petite Rosselle (Moselle)

NETHERLANDS

Prof. Dr. W. MAAS, chef van de Veiligheidsdienst der Staatsmijnen in Limburg, van der Maesenstraat 2, Heerlen (L.)

5b) Sessions of the Sub-Committee

1.	24th January 1961
2.	20th April 1961

3. 15th November 1961
4. 7th and 8th February 1962
5. 16th May 1962
6. 25th June 1962
7. 4th September 1962
8. 25th September 1962
9. 6th February 1963
10. 14th June 1963
11. 21st June 1963
12. 2nd and 3rd October 1963
13. 13th December 1963
14. 24th January 1964
15. 8th April 1964
16. 27th May 1964
17. 22nd June 1964
18. 18th November 1964
19. 8th and 9th January 1965
20. 17th February 1965
21. 7th May 1965
22. 14th June 1965
23. 23rd September 1965
24. 19th and 20th October 1965
25. 9th December 1965
26. 26th January 1966
27. 9th March 1966
28. 4th May 1966
29. 18th May 1966
30. 22nd June 1966

III. Working Party on "Mine rescue organization"

a) Composition

GERMANY

Ministerialrat W. LATTEN (1), Ministerium für Wirtschaft, Mittelstand und Verkehr, Land Nordrhein-Westfalen, 4000 Düsseldorf, Haroldstr. 4

Dipl. Ing. E. BREDENBRUCH, Leiter der Hauptstelle für das Grubenrettungswesen des Steinkohlenbergbauvereins, 4300 Essen-Kray, Schönscheidtstr. 28

A. VAN GEMBER, Erster Bergrat a.D., Direktor der Grubensicherheitsabteilung der Saarbergwerke AG, 6600 Saarbrücken, Triererstr. 1

Dipl. Ing. A. SCHEWE, Technischer Leiter der Hauptstelle für das Grubenrettungswesen des Steinkohlenbergbauvereins, 4300 Essen-Kray, Schönscheidtstr. 28

BELGIUM

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A. HAUSMAN, directeur du Centre de coordination des moyens de sauvetage de Campine, 555, Kempische Steenweg, Hasselt

(1) As representative of the Restricted Committee.

FRANCE

R. GRISARD, ingénieur des mines, Charbonnages de France, 99, avenue Percier, Paris 8e

C. ROGEZ, directeur du poste central de secours des mines du Nord et du Pas-de-Calais, rue du Bois, Lens (Pas-de-Calais)

ITALY

Dott. Ing. G. CARTA, direttore generale della Carbonifera sarda con sede in Carbonia, via Napoli 11, Carbonia (Cagliari)

Ing. G. GHIANI, Carbonifera sarda con sede in Carbonia, via Napoli 11, Carbonia (Cagliari)

LUXEMBOURG

A. RAUS, directeur à l'A.R.B.E.D., Luxembourg

R. MAYER, ingénieur des mines à l'A.R.B.E.D., Esch-sur-Alzette, Aloys Kayserstr. 22

NETHERLANDS

Ir. F.A.F. SIEVERS, chef van de Veiligheidsdienst, Oranje-Nassau Mijnen, Heerlen (L.)

Prof. Dr. W. MAAS, chef van de Veiligheidsdienst der Staatsmijnen in Limburg, Heerlen (L.)

UNITED KINGDOM

W.A. WOOD, Director of Safety, National Coal Board, Hobart House, Grosvenor Place, London S.W.1

b) Sessions of the Working Party

1. 28th July 1961
2. 10th October 1961
3. 8th February 1962
4. 12th April 1962
5. 23rd May 1962 (with medical experts at la Centrale de Sauvetage à Frâmeries
6. 3rd July 1962 (with medical experts)
7. 29th September 1962 (with medical experts)
8. 26th March 1963
9. 6th June 1963
10. 11th December 1963
11. 28th February 1964 (Coördinatiecentrum Reddingswezen, Hasselt)
12. 10th November 1964
13. 30th June 1965
14. 3rd September 1965
15. 7th and 8th October 1965 (Institut Physiologique, Liège - Coördinatiecentrum Reddingswesen, Hasselt)

16. 14th January 1966
17. 25th February 1966

IV. Working Party "Winding ropes and shaft guides"

a) Composition

GERMANY

Dipl. Ing. K. DÜWELL, Leiter der Seilprüfstelle der Westfälischen Berggewerkschafts-kasse, 4630 Bochum, Dinnendahlstr. 9

Dr.-Ing. R. MEEBOLD, Direktor der Seilprüfstelle der Saarbergwerke AG, 6600 Saarbrücken Triererstr. 1

Dipl. Ing. H. GRUPE, Seilprüfstelle der Westfälischen Berggewerkschaftskasse, 4630 Bochum, Dinnendahlstr. 9

BELGIUM

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J. STREBELLE, directeur, association des industriels de Belgique (A.I.B.), 29, rue A. Drouard, Bruxelles

FRANCE

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C. ROGEZ, directeur du poste central de secours, Nord et Pas-de-Calais, rue du Bois, Lens (Nord)

M.P. SIDO, directeur de l'association des industriels de France, 10, rue de Calais, Paris 9e

A. BURGUN, ingénieur à l'association des industriels de France, 10, rue de Calais, Paris 9e

ITALY

Prof. Dott.-Ing. C. MORTARINO, istituto di meccanica applicata del politecnico di Torino, 24, corso Duca degli Abruzzi, Torino

Prof. Dott.-Ing. L. STRAGIOTTI, dirèttore dell'istituto di arte mineraria del politecnico di Torino, via S. Quintino 42, Torino

LUXEMBOURG

E. MÜLLER, ingénieur des mines à la division des mines luxembourgeoises à l'A.R.B.E.D., Esch-sur-Alzette

NETHERLANDS

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Ir. J.A.R. HOEFNAGELS, inspecteur der mijnen, Staatstoezicht op de Mijnen, Apollolaan 9, Heerlen (L.)

Ir. SMULDERS, Laura en Vereeniging, Eygelshoven (L.)

Ir. VAN BLARICUM, Staatstoezicht op de Mijnen, Apollolaan 9, Heerlen (L.)

UNITED KINGDOM

G.K. GREENOUGH, Head, Mechanical Engineering Section, Ministry of Power, Safety in Mines, Research Establishment, Red Hill, Off Broad Lane, Sheffield 3

b) Sessions of the Working Party

1.	25th January 1961
2.	21st November 1961
3.	26th and 27th February 1962 (Seilprüfstelle, Bochum)
4.	17th December 1964
5.	23rd February 1965
6.	5th April 1965
7.	15th October 1965

V. Working Party on "Inflammable dusts"

a) Composition

GERMANY

Oberbergamtsdirektor K. HUEBNER, Leiter der Unterabteilung Montanwirtschaft des Ministeriums für Wirtschaft, Verkehr und Landwirtschaft des Saarlandes, 6600 Saarbrücken, Hardenbergstr.

Dipl. Ing. E. BREDENBRUCH, Leiter der Hauptstelle für das Grubenrettungswesen, 4300 Essen-Kray, Dortmunderstr. 209

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K. KRAEMER, Industriegewerkschaft Bergbau und Energie, 4630 Bochum, Alte Hattingerstr. 19

(1) As representative of the Restricted Committee.

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E. DEMELENNE, administrateur directeur de l'Institut national des mines, 60, rue Grande, Pâturages

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FRANCE

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A. REBIERE, chef du service hygiène et sécurité minière à la direction des mines, Ministère de l'industrie et du commerce, 97, rue de Grenelle, Paris 7e

R. LOISON, directeur des groupes de recherches CERCHAR, 35, rue Saint-Dominique, Paris 7e

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L. CHAUVEAU, Fédération nationale des syndicats chrétiens des mineurs, 8, rue de Navarre, Paris 7e

J. POREBSKI, Fédération nationale de la force ouvrière des mineurs, 247, bd. de la Victoire, Annequin (Pas-de-Calais)

ITALY

Ing. G. GIROLAMI, ispettore generale delle miniere, Ministero dell'industria e commercio, via Veneto 33, Roma

NETHERLANDS

Ir. D.J. KNUTTEL, hoofdinspecteur der mijnen, Staatstoezicht op de Mijnen, Apollolaan 9, Heerlen (L.)

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UNITED KINGDOM

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G. HOYLE, Deputy Chief Inspector of Mines and Quarries, Ministry of Power, Thames House South, Millbank, London S.W. 1

Dr. D.W. WOODHEAD, Safety in Mines Research Establishment, Field Laboratories, Harpur Hill, Buxton (Derbyshire)

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(1) As representative of the Restricted Committee.

b) Sessions of the Working Party and its Sub-Committees

1. 2nd and 3rd February 1966
2. 17th February 1966
3. 18th March 1966
4. 16th June 1966

VI. High Authority competition for improved mine safety equipment

a) Composition

GERMANY

Ministerialrat W. LATTEN, Ministerium für Wirtschaft, Mittelstand und Verkehr des Landes Nordrhein-Westfalen, Düsseldorf, Haroldstr. 4

Prof. Dr.-Ing. E. LINSEL, Leiter der Forschungsstelle für Grubenbewetterung, Essen-Kray, Dortmunderstr. 151

Dipl. Ing. E. BREDENBRUCH, Leiter der Hauptstelle für das Grubenrettungswesen, Essen-Kray, Schönscheidtstr. 28

FRANCE

R. CHERADAME (Präsident/président), directeur général au CERCHAR, 35, rue Saint-Dominique, Paris 7e

A. REBIERE, chef du service hygiène et sécurité, Direction des mines, Ministère de l'industrie et du commerce, 97, rue de Grenelle, Paris 8e

C. TERRIER, directeur aux Charbonnages de France, 9, avenue Percier, Paris 8e

BELGIUM

L. BRISON, professeur à la Faculté polytechnique de Mons, 9, rue de Houdain, Mons

ITALY

Ing. P. CERULLI, ispettore generale delle miniere, Ministero dell'industria e commercio, 33, via Veneto, Roma

NETHERLANDS

Dr. W. DE BRAAF, directeur van het centraal proefstation der Staatsmijnen, Treebeek

b) Sessions of the Jury and its Report Groups

1.	27th April 1961
2.	14th December 1961
3.	9th February 1962
4.	8th and 9th October 1964
5.	4th and 5th November 1964
6.	20th November 1964
7.	18th January 1965
8.	4th February 1965 (Essen-Kray)
9.	10th February 1965 (Bochum)
10.	10th March 1965 (Pâturages)
11.	17th March 1965 (Essen-Kray)
12.	23rd March 1965 (Essen-Kray)
13.	24th March 1965 (Verneuil)
14.	29th March 1965
15.	21st June 1965 (Verneuil)
16.	19th and 20th July 1965 (Pâturages)
17.	10th September 1965 (Heerlen-Trebeek)
18.	27th September 1965

D.- WORKING PARTIES ON "HUMAN FACTORS"

I. Working Party on "Effects of working time on safety of work, especially in difficult or unhealthy conditions"

a) Composition

GERMANY

Berghauptmann Dr. FUNDER, Oberbergamt, 4600 Dortmund

Bergwerksdirektor H. MIDDENDORF, Bergassessor a.D., Steinkohlenbergwerke Mathias Stinnes AG, 43 Essen-West

E. STEBEL, Industriegewerkschaft Bergbau und Energie, 4630 Bochum, Alte Hattinger-str. 19

BELGIUM

VAN MALDEREN, ingénieur en chef, directeur des mines à la Direction générale des mines, 6-8, rue de la Science, Bruxelles

M.J. SAUCEZ, attaché au Centre de formation postuniversitaire pour ingénieurs de charbonnages, 141, rue de l'Espinette, Quaregnon

F. BIJNENS, Torenveldstraat 10, Beringen

FRANCE

P. BOURELIER, ingénieur des mines, Cité administrative, 2, rue de l'Hôpital militaire, Strasbourg (Bas-Rhin)

C. TERRIER, directeur aux Charbonnages de France, 9, avenue Percier, Paris 8e

A. AUGARD, secrétaire général adjoint de la Fédération nationale de la force ouvrière des mineurs, 169, avenue de Choisy, Paris 13e

ITALY

Ing. G. BULGARELLI, capo del distretto minerario di Padova, via Baiamonti 1, Padova

Prof. M. CARTA, Istituto arte mineraria, società Carbosarda, Cagliari (Sardegna)

L. BACCI, Uilmec, via Sicilia 154, Roma

NETHERLANDS

Ir. D.J. KNUTTEL, hoofdinspecteur der mijnen, Staatstoezicht op de Mijnen, Heerlen, Apollolaan 9

Ir. F.W. FENNELL, hoofdingenieur van de Staatsmijnen in Limburg, p/a Staatsmijn Wilhelmina, Terwinselen (L.)

H.L. GROND, Katholieke Vereniging van Mijnbeambten, Schelsberg 202, Heerlerheide (L.)

Drs. D.C. VAN DER HOOFT (1), hoofd van de directie mijnwezen, Ministerie van Economische Zaken, Bezuidenhoutseweg 30, 's-Gravenhage

UNITED KINGDOM

R. BELL, National Coal Board, Production Department, Hobart House, Grosvenor Place, London S.W. 1

b) Sessions of the Working Party

1.	29th June 1962
2.	20th November 1962
3.	15th March 1963

1a) Sub-Committee

GERMANY

Berghauptmann Dr. FUNDER, Oberbergamt, 4600 Dortmund

Bergwerksdirektor H. MIDDENDORF, Bergassessor a.D., Steinkohlenbergwerke Mathias Stinnes AG, 43 Essen-West

BELGIUM

Frans BIJNENS, Torenveldstraat 10, Beringen

FRANCE

André AUGARD, secrétaire général adjoint de la Fédération nationale de la force ouvrière des mineurs, 169, avenue de Choisy, Boîte postale 325, Paris 13e

(1) As representative of the Restricted Committee.

ITALY

Prof. Mario CARTA, Istituto arte mineraria, società Carbosarda, Cagliari (Sardegna)

NETHERLANDS

Drs. D.C. VAN DER HOOFT, hoofd van de directie mijnwezen, Ministerie van Economische Zaken, Bezuidenhoutseweg 30, 's-Gravenhage

1b) Sessions of the Sub-Committee

1. 22nd September 1961
2. 3rd May 1962

2a) Medical experts

GERMANY

Prof. Dr. med. habil. H. BRUENER, 532 Bad Godesberg, Kölnerstr. 70

Prof. Dr. med. G. LEHMANN, Max Planck Institut für Arbeitsphysiologie, 4600 Dortmund, Rheinlanddamm 201

BELGIUM

Professeur F. LAVENNE, Institut d'hygiène des mines, Hasselt

Docteur LEYH, Institut d'hygiène des mines, Hasselt

FRANCE

Docteur KRAFFT, médecin-chef aux mines de potasse d'Alsace, Mulhouse

NETHERLANDS

Drs. K.R. KOOPMANS, Akerstraat 116 a, Heerlen

II. Working Party "Medical problems of a safety policy"

a) Composition

GERMANY

Regierungsdirektor W. SCHNASE, Bundeswirtschaftsministerium, Referat III A I, 53 Bonn

Dr. med. G. SCHAEPER, Dortmunder Bergbau AG, 4600 Dortmund, Katharinenstr. 9

H. BULLA, Industriegewerkschaft Bergbau und Energie, Bochum, Alte Hattingerstr. 19

BELGIUM

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Docteur VAN MECHELEN, médecin-chef de l'Institut d'hygiène des mines, 24, Havermarkt, Hasselt

R. BALESS, secrétaire national de la Centrale syndicale des travailleurs des mines de Belgique, 8, rue Joseph Stevens, Bruxelles

FRANCE

A. REBIERE, chef du service hygiène et sécurité minière à la Direction des mines, Ministère de l'industrie, 97, rue de Grenelle, Paris 7e

Docteur AUPETIT, médecin-chef du groupe d'Oignies des houillères du bassin du Nord et du Pas-de-Calais, 20, rue des Minimes, Douai (Nord)

L. CHAUVEAU, Fédération nationale des syndicats chrétiens des mineurs, 8, rue de Navarre, Paris 5e

Alternate : M. SAUTY, Fédération des Mineurs, 10, rue Diderot, Lens (Nord/ Pas-de-Calais)

ITALY

Dott. C. MICHELAZZI, ispettore capo del lavoro addetto alla divisione sicurezza e igiene del lavoro, Ministero del lavoro, Roma

Prof. E. BARTALINI, direttore dei servizi sanitari della soc. Montecatini, 18, via Turati, Milano

A. GUAITA, Iglesias (Cagliari) (Sardegna)

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(1) As representative of the Restricted Committee.

NETHERLANDS

Drs. D.C. VAN DER HOOFT, hoofd van de directie mijnwezen, Ministerie van Economische Zaken, Bezuidenhoutseweg 30, 's-Gravenhage

Dr. med. A.V.M. MEY, directeur geneeskundige dienst der Nederlandse Steenkolenmijnen, Horizonstraat 75, Treebeek (L.)

C. FEENSTRA, voorzitter van de Protestant-Christelijke Mijnwerkersbond, Burg. de Hesselleplein 26, Heerlen

UNITED KINGDOM

Dr. med. J.M. DAVIDSON, Safety and Health Division, Ministry of Power, Thames House, South Milbank, London S.W. 1

b) Sessions of the Working Party

15th September 1961

1a) Medical experts

GERMANY

Oberregierungsmedizinalrat Dr. med. R. WAGNER, Bundesministerium für Arbeit und Sozialordnung, 53 Bonn

Alternate : Herr Ministerialrat Dr. med. MEYERINGH, Bundesministerium für Arbeit und Sozialordnung, 53 Bonn

BELGIUM

Docteur P. KISTERS, inspecteur général, chef de l'Inspection médicale du travail, 128, avenue de Broqueville, Bruxelles 15

FRANCE

Docteur J.J. JARRY, Charbonnages de France, 9, avenue Percier, Paris 8e

ITALY

Prof. P. DIDONNA, ispettore generale del lavoro, capo dell'Ispettorato medico del lavoro, libero docente di medicina del lavoro nell'Università di Roma, via S. Basilio, 41, Roma

NETHERLANDS

H. ITALIE, Arts, inspecteur der mijnen, Staatstoezicht op de Mijnen, Heerlen, Apollolaan 9

III. Working Party "Psychological & sociological factors in safety"

a) Composition

GERMANY

Regierungsdirektor W. SCHNASE (1), Bundeswirtschaftsministerium, Referat III A 1, 53 Bonn

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b) Sessions of the Working Party

1. 13th March 1964
2. 10th and 11th November 1965
3. 6th and 7th January 1966

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1b) Sessions of the sub-committee

1. 15th May 1962
2. 13th July 1962
3. 18th September 1963

IV. Working Party on "Effects of methods of payment on safety"

a) Competition

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1. 23rd and 24th March 1964
2. 20th January 1965
3. 21st March 1966

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1b) Sessions of the Sub-Committee

1. 15th May 1962
2. 13th July 1962
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