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MEMORANDUM

Establishment of a second research programme

"Safety in Mining"

(submitted to the Council by the Commission)

 Com 101

M E M O R A N D U M

Establishment of a second research programme

'Safety in Mining'

I. INTRODUCTION

Article 55 of the European Coal and Steel Community Treaty deals with the promotion and financing of technical and economic research relating to the production and increased use of coal and steel and research on occupational safety in the coal and steel industries of the Community.

Since 1969 a total of 10 113 566 RCU has been allocated for safety research in coal and ironstone mining. Until 1976 projects were proposed and agreed in an individual manner without recourse to an overall programme but in that year, in response to the desires expressed by all relevant bodies of the mining industry, the Commission, on 21 December 1976, instituted a research programme 'Safety in mines' of five years' duration and involving 7 500 000 ECU of financial aid. This aid has now been allocated for implementing the programme.

In addition to this research directed specifically to safety in mining the Commission financially aids mining research through the 'Medium-term research aid programme for coal' under Directorate-General XVII, 'Energy', and the 'Programme on ergonomics for the steel and coal industries' under Directorate-General V, 'Employment and Social Affairs', both having a bearing on safety in mining. The Safety and Health Commission for the Mining and Other Extractive Industries is active in the safety field, mainly through exchanges of experience and information within the Community countries, and under its terms of reference can propose research into mine safety matters. Results of research pertinent to mine safety are notified to this body as they become available. The need to harmonise all these interests is critical and in the operation of any mining safety programme all the efforts made by the Commission and by pertinent bodies outside of the Commission must be considered and taken fully into account.

With the increasingly important part being played by coal in the world energy situation, the need for the Community to exploit this indigenous energy source to the maximum is paramount, necessitating a mining industry offering the safest working conditions possible.

Furthermore, the iron and steel industry has a very real interest in seeing occupational safety research extended. Research of service to both industries is not ruled out under the proposed programme. The main aim of the programme ought not merely to be

the prevention of group or even fatal accidents - a major concern in mining - but also to seek suitable methods of preventing other industrial accidents which constitute a clear majority statistically speaking.

The establishment of a second research programme 'Safety in mining' is considered necessary. The first programme, in spite of the limited finances available, has nonetheless achieved considerable impact on safety. To consolidate this impact and also to try to ensure that safety research keeps abreast of and even tries to anticipate the technological advances taking place, a further research programme is proposed, as a harmonious continuation of and with the same broad lines as the previous one. All relevant bodies within the mining industry of the Community have been consulted and all agree on the need for a second programme.

II. THE SAFETY PROGRAMME

1. General

The degree of mechanization has continued to increase, as has concentration of working with resulting increased unit tonnages. Bulkier, heavier, more powerful machines with greater capacities are being used for the winning of coal and driving roadways and for mineral transportation. More difficult thinner and thicker seams are being worked at greater depths below the surface than in previous years. Mining technology and operations now involve integrated

systems and sub-systems of winning, support, transportation and control. The tempo of all operations has increased and with concentration of production and despite increases in productivity more men may be concentrated on a working unit, thus occasioning the greater possibility of incidents of a major nature, besides resulting in individuals and small groups working intensively in isolation, whose safety, and the safety of others who can be affected although remote from them, must be ensured. Aspects of monitoring, data transmission and presentation of information, remote and automatic control have made rapid strides with attendant benefits, although they have not solved all the problems and have brought new ones to light.

These changes have tended to alter the pattern and incidence of accidents and call for close attention and analysis, as do the suitability and compatability of emerging highly sophisticated integrated systems and sub-systems of winning, support, transport and control. The approach to safety needs to be equally sophisticated both in identifying hazards and providing solutions for their removal.

Past experience has pinpointed the need to give attention to both individual and collective incidents. This emphasis still holds good and both should continue to receive attention.

A particular facet of the first safety programme was that it was devoted exclusively to underground matters. This was intentional, but experience and the changing pattern of mining methods

and accidents has pointed up the need to include the safety of surface activities and opencast mining operations. This is particularly so where the advent of increased production necessitates the provision of new and modernized surface layouts and plants at the same time as production continues, so compounding possible danger. Opencast mining is an expanding source of coal and iron ore and it is considered that the time is propitious to look more closely at, and if possible devote more research effort to, the particular safety problems inherent in this method of mineral winning.

2. The first programme

The first programme comprised some 30 projects selected following the usual consultations.

In many cases research has reached the stage where results have been achieved in development and prototypes but still needs more work to effect the transition to regular, safe, underground use. In many other cases research is still on-going.

The following illustrate briefly some of the research undertaken and progress made in the main fields.

(a) Fires and underground combustion.

Much attention was devoted to the subject of mine fires and heatings, since these accidents continue to constitute a major hazard. Particular emphasis was laid on early detection and warning of their occurrence in adverse situations such as hidden fires.

Progress was made in the development of various types of detector coupled to data transmission and warning systems. The work done has tended to emphasize that a standard system is unlikely but rather several different systems are needed to cater for the different types of fires and the circumstances in which they occur.

Further work should be carried out on detectors, on selecting them and adapting them to mine conditions. Progress has, however, been made in eliminating false alarms occasioned by CO emanating from sources other than fires, for example from shot-firing operations or diesel-engined vehicle movements.

The optimum positioning of detectors for detection of small-scale fires in wide cross-section roadways has been studied and shows that the readings of the CO evolved indicates stratification in the roadway linked to variations in airspeed; the precise pattern of CO stratification needs to be determined.

Progress has been made towards more satisfactory fire-resistant greases. Many were subjected to fire resistance scrutiny, after which several were deemed satisfactory for engineering tests. From these, three have emerged and will be subjected to further operational trials.

No positive outcome has yet resulted from efforts to try to devise a small-scale test to determine the degree of fire resistance of conveyor belts.

(b) Explosions.

The risk of explosions underground caused either by firedamp or by dust still remains a matter for real concern.

Frictional firedamp ignitions, their parameters and suppression were investigated and fresh knowledge was gained of them.

The possibility of suppressing these ignitions close to their source has been studied and methods and equipment have been developed to suppress ignitions of methane and coal dust with the firedamp detector and suppressor mounted on the coal winning machine. These have been successfully tested on some machines and in the experimental mine.

Attention was given to the development of triggered barriers for the automatic suppression of explosions. Various types have been tested based on different sensing principles but in general they use water as the suppressant. A limited number are at the final study stage or undergoing trials underground. In the latter two fields, various types need to be developed further and their specifications and operating efficiency under various likely conditions compared.

(c) Rescue.

Research into rescue methods under the first programme was not on a wide scale, probably because considerable work had been done, prior to the programme, on the rescue of trapped miners.

One area receiving particular attention related to self-contained self-rescuers. The ones currently in general use are unsatisfactory in oxygen deficient atmospheres and attention is turning towards types able to overcome this shortcoming. Self-contained apparatus (chemical oxygen) is in everyday use in some Community mines (coal, potassium, uranium, bauxite). To this end practical underground response and storage tests were put in hand to ascertain the long-term reliability of such apparatus.

(d) Surveillance, telemetry, remote control, automation and communication.

In this field a considerable amount of work was undertaken and much of it, inevitably, related to fire detection and presentation of information concerning fires. This resulted in considerable progress in mine air analysis and relevant information provision using computers and data transmission systems.

Following on the development of a television camera system for use in boreholes for rescue purposes, research was instigated on the development of a television system for the monitoring of shafts and large boreholes of greater depths.

Research has related to the use of radio and electromagnetic communication methods in underground rescue operations. This has shown that the use of low frequency direct propagation radio signals as a possible means of communicating through strata is not suitable for the longwall workings at the depths found in the coal mines of the Community. Methods of communication between rescue teams and base, using micro-waves, are being examined and developed.

Radio systems have been studied which detect persons entering an area made dangerous by the presence of operating machinery and stop the machinery in such circumstances.

(e) Methods of working.

Under this heading a fairly wide range of topics was tackled. Attention was focussed on stricter control and protection from falls of ground in ironstone mines and from this emerged a prototype system giving warning of impending falls of ground which, with further development, may be of use on a wider scale.

Research related to a remotely controlled system of coal loading in an endeavour to remove personnel from danger areas (falls of ground, dust, gas outbursts). The remote operation of machinery with television control was tested and followed up by industrial-scale development.

In the field of explosives work was done to try to determine the causes of incomplete detonation of explosives, which sometimes occurs when firing rounds of shots. Difficulty was experienced in developing a satisfactory method for measuring the pressures in shot-holes during shotfiring operations, but one was devised. Using this method the effects when shotfiring in rock has been assessed as regards the relationship between charge weights and distance between shot-holes without interference being caused. Further work will assess the relationship in other types of strata and when using various types of explosives.

Research is being carried out into the safe operation of conveyors. The aim is to develop a clutch/brake unit to reduce conveyor over-run on stopping. A prototype device designed to prevent inadvertent movement of power loader machines on level faces and steep gradients was developed.

(f) Electricity.

This research covered the development of high-speed fault detection and circuit breaking devices together with wider ranging improvements of safety aspects in electrical networks and equipment.

A system has been developed for the rapid detection of small and large current faults. Used with rapidly tripping switch-gear a cut-off time of 13 milli-seconds has been achieved with fault currents in excess of the motor starting currents. In addition the system will detect minor short circuits which were not detectable before, although in this case the time involved is greater. The system is being tried underground at a producing mine. Laboratory testing of switchgear circuits incorporating thyristors is being undertaken, as a result of which, it is hoped, the system operating time will be reduced to less than 10 milli-seconds.

(g) Metallurgy.

Research looked particularly at winding systems with emphasis on the geometry of braking methods and safer control of winding operations, particularly as regards slipping and slack ropes. The brake geometry research was particularly revealing and

as a result of the investigations and the findings applied, winding operations were considered to have been made considerably safer.

(h) Accidents and accident information.

This field unfortunately attracted little attention and only two projects were undertaken. One concerned the reduction of accidents in locomotive and rope hauled transport systems operating on floor mounted rails. As a result several developments are installed underground, either fully tested or on trial.

Track mounted energy absorption units for stopping over-speeding vehicles have been tested and several are in use underground. Also developed and installed underground is an electronic overload protection device which cuts power at pre-determined loadings of the rope in a rope haulage system.

Trials are also underway to assess the suitability of rack and pinion drive systems for underground locomotives operating on steep gradients.

The second project is using computerized information to try to relate accidents to systems and working methods employed.

(i) Noise

Only one project was carried out under the first programme, dealing with noise exposure and control in roadways, headings and main-riding systems.

3. Contents of the second programme

The new programme is intended to continue and supplement the old one and provide the main headings under which research should be done.

The scope would be widened from the previous programme to include both surface matters and opencast mining in the coal and iron-ore industries. Besides this widening of scope it is considered that benefits would ensue from the addition of two major fields of research, 'Transport and handling' and 'Rockbursts and associated phenomena'. Both were included as topics in other fields in the old programme but experience and events indicate that these are worthy, in their own right, of consideration as main fields of research. Many accidents are associated with the use of plant and machinery, transportation and handling of materials. In addition, in order to try to improve the safety record of transport and handling and associated operations a separate field of research for this would be beneficial.

Rather than listing all possible projects, the programme is intended to define the main research fields and to sketch the broad schemes under which projects may be submitted. Under these could come the continuation and termination of research which showed promise under the first programme, research to consolidate progress and gains already made, and new lines of research to keep pace with new developments and requirements in an attempt to achieve a safer working environment for those engaged in the winning of coal and iron-ore.

In the past the need for Community research in which a topic is undertaken jointly by several institutes was stressed. This has achieved limited response so far and once again it is stressed that this type of research shows considerable benefits and more of it must be undertaken.

It is proposed that a new programme entitled 'Safety in mining' is formulated under the following headings, under which main themes of research are indicated. The order of presentation is not intended to indicate an order of priority in either the fields or the themes of research.

a) Accidents and data on accidents
Human factors and safety

With increased mechanization and associated changes the distribution of accident locations and types has tended to change and the growing complexity of machinery, supports transport, methods, systems of operation and control have all contributed to the changes.

It is essential that the safety aspects of all systems should be evaluated and techniques developed for the assessment of safety aspects of systems operative right through from the design to the application stages.

The use of computers has improved coverage of the factors involved in the origin of accidents.

Research should include in particular the following themes:

Identification of potential hazards in existing techniques and systems and those being developed, with computer simulation practices

being adopted to this end.

Analysis and presentation of data on accidents using all available investigation techniques, with the aim of developing the most significant and useful methods.

Work aimed at improving individual attitudes to safety and providing a new approach to accident prevention and training, with improved methods of communicating advice and instructions, whilst improving understanding of work situations and involving the workforce.

Attention to the safety aspects of automation and remote control methods.

A study of the specific requirements of operational safety during reconstruction work.

A study of the harmful effects of noise on safety.

Study of the effects of improved lighting on safety.

b) Fires and underground combustion.

The occurrence of spontaneous combustion and open fires has not yet been eliminated in mines. Continuing and constant efforts must be made towards minimizing the possible occurrence of fires and heatings, their early detection and warning should they occur, methods of combating them, both manual and automatic, and methods of dealing with the situation should direct control over an incident be lost.

To this end the following broad themes of research are pertinent:

Development of fireproof and fire-resistant apparatus, materials and fluids together with suitable fire resistance tests, and where necessary, tests for other hazards, such as toxicity with particular attention to new substances being used. Special attention should be paid to fire and explosion hazards associated with diesel vehicles, particularly their tyres.

Research into belt conveyors should be continued. Particular emphasis should be laid on the fire-resistant properties of high-capacity and power conveyors. Test method comparisons should also be continued. The aim is to discover test methods which can be applied to conveyors actually in use.

The continued development and trials of early detection and warning systems for fires and spontaneous heatings, ensuring compatibility for inclusion in general mine monitoring and information systems.

Development of suitable extinguishing methods for heatings and fires, the latter to cover both the fixed and mobile situation.

Research into underground welding techniques for metal components.

Development of systems for automatic or remote controlled construction of fire seals.

Research into spontaneous combustion and fires related to incidence and development according to mine configurations and ventilation and corrective actions which can be determined using computers.

c) Explosions.

The increased use of pick and roller-cutter type machines for coal winning and roadway drivage increases the possibility of frictional sparking hazards, to which further attention must be given.

Substantial research work has been conducted on triggered explosion suppression barriers but further development to gain general underground acceptance is necessary.

Although increased mechanization has brought about a reduction in the use of explosives, research into improving explosives safety, particularly that of new types, must continue.

Consequently, research under the following themes should be pursued:

The development and testing of processes for eliminating ignition hazards caused by sparking, frictional heat and heated surfaces.

The perfecting and comparing of existing explosion arresting triggered barriers and the development of methods of arresting explosions close to their source to arrive at practical systems acceptable for use underground.

Basic research into gas and dust explosion processes. This research ought to cover a wide range of parameters, for example:

- type and strength of primary explosion
- nature of the dust: its flammability in relation to its volatile and incombustible matter content;
- the presence of gas, leading to mixed explosions.

Experiments on mine explosions, covering parameters such as:

- length, cross-section and layout of roadways;
- air speed;
- varying types and locations of dust deposits.

The representativeness of a dust deposit (either settled or in suspension) as regards explosion propagation hazards.

Determination of the efficiency of stonedust monitoring methods.

Along the same lines, perfection of an instant flammability rating procedure for deposited dust.

Improvement and evaluation of the level of safety afforded by new explosives and shotfiring techniques.

This type of research should be coordinated with work covered by a research programme on occupational health in mines.

d) Rescue.

It is unlikely that the development of filter type self-rescuers can be taken further in practical terms and research should therefore be directed towards improving and inventing alternative forms of self-rescuers. There is a need for further research on the rescue of trapped miners and improvements to equipment and communication and warning systems in rescue work are considered necessary.

Research should be pursued as follows:

Improvement, design and development of alternative self-rescuers

particularly high performance, lightweight, self-contained escape devices.

Further development and trials of breathing and cooling apparatus for rescue team members.

Development of improved methods of communication during rescue operations.

Further development of dual-purpose measurement and alarm apparatus for rescue teams, including a mobile underground laboratory.

Attention to the optimizing of first aid systems and the development of suitable methods for the transportation of injured persons, adaptable to and compatible with transport methods normally available.

Work should continue on improving detecting, contacting and rescue methods of trapped persons by methods operating from either the surface or underground and the development of suitable methods and equipment for rescue in the situation resulting from falls of ground.

e) Monitoring, telemetry, data presentation, remote control, automation and communication.

Rapid strides have been made of late in the use of computers with measuring instruments and data transmission systems for information on and control of mine atmospheres, and further progress can be expected as new techniques emerge. The advent of high production mines and high output coal faces and the introduction of remotely controlled equipment increases the need for monitoring

and telemetry in operations at the coal face, in drivages and elsewhere. The safety of remotely controlled and automated operations should be studied to establish safe operating procedures. With increased isolation of working groups and individuals in some cases, easy and ready means of communication are needed.

Themes for research should be as follows:

The design, development and installation of safe equipment and systems for monitoring and controlling the operations of equipment and machinery and means for ensuring their safety, including methods of ensuring the operational reliability of programmes governed by micro-processors.

Further development in the monitoring and control of winding equipment and operations.

Development of reliable safety systems for remote controlled and automated operations.

The development of safe systems of communication and methods of achieving the safety of electrical circuits used for remote and automatic control.

Study of message comprehension underground.

f) Transport and handling.

This section is made a field of research in its own right chiefly, as indicated, to focus attention on the rising accident trend in mine transport operations. In addition, with the increase in the number of high-output faces new problems have arisen for materials handling.

Equipment serving the transport needs of men and material

is undergoing radical changes with heavier loads, higher speeds and more sophisticated vehicles becoming the order of the day. Heavier and more cumbersome equipment has to be transported and handled through shafts, roadways and faces.

These changes and the adverse accident trends need research directed at specific themes which should apply equally to shafts and inclined and horizontal roadways. The themes are:

The evaluation and testing of the safety aspects of all transport systems.

The development of new and automated systems to replace dangerous ones involving large numbers of men.

The study of the safety aspects in connection with the use of conveyor belts for man-riding purposes and problems posed by sequential control of conveyors.

The study of the problems raised by the transport and handling of heavy and bulky materials in shafts, roadways and faces and those associated with the increased use of transportation systems arising from the necessity to bring large quantities of material to the surface to effect necessary maintenance and repairs.

g) Electricity.

The methods of working now employed involve the use of far more electrical power, more powerful motors and higher voltages throughout the workings. This results in the need for continued research into material and equipment safety from the point of view

of explosion and fire risks and also the general safety of high voltage circuits.

Research should be directed towards the following themes:

Continuation of work with the aim of successful practical applications of rapid tripping of electrical circuits in adverse situations.

The study of all aspects of static electricity, particularly in the context of the greater use of synthetic materials in the mining industry.

Improvement of electrical apparatus explosion protection methods, particularly for safety sensors (firedamp detector heads etc.).

Aspects of the safety of electrical operating and control systems with particular reference to mobile equipment, high voltages at the face and the design of cable connections.

The safe use and satisfactory testing of electrical networks and equipment, particularly reliability testing before equipment is used underground; the safe use of accumulators and the development of safe cableless systems of power supply. (This applies particularly to power supply to winning machines at the face via fixed conductors).

Study of methods for testing electrical apparatus using firedamp intrinsic safety measuring devices.

Protection against electric shock.

h) Materials technology.

The advent of more powerful machinery for winning and transportation and the consequent use of higher energy inputs

increase the problems posed by higher working stresses, often in a hostile environment. There exists therefore the need to make use of the most suitable materials available and to develop techniques which will reveal the risks and possibility of machine and equipment failure in use. These developments used underground could well reduce the need for transportation of defective and replacement material with its attendant handling hazards, particularly in shafts and roadways.

Research should be directed to the following:

The development of simple, safe, non-destructive tests with direct readout of results.

Study of new materials suited to the particular circumstances obtaining in mines.

The evaluation of strain aging techniques aimed at identifying the moment when items of equipment should be withdrawn from service.

The application of 'fracture mechanics' to all materials and the development of suitable tests on new materials and on the deterioration of worn materials, with particular identification of safety levels for the latter.

i) Working methods.

Modern methods of mining use all forms of technology and permit not only extraction of seams of normal thickness but also the working of certain seams hitherto considered unworkable. The accelerating development of complex coal winning and roadway drivage systems and control needs closer scrutiny, as do the safety

aspects of systems and sub-systems relating to machinery, equipment and methods. Modern methods give rise to particular problems of safety for persons beyond the immediate area of operation or control and these must be continuously borne in mind during such scrutiny.

In addition, this field should cover exploration of the potential of computer and situation techniques.

The following research topics could be proposed:

Safety aspects of the mechanized working of thick or thin, steeply inclined seams in relation to web depth, ground nature and to the mechanization of roadway advancement.

Roof control as regards the safety of support and stowing systems and the measures to counter falls of ground, particularly in disturbed or discordant areas of ground.

Development of warning devices and of automatic power cut-off systems to afford protection to persons from machinery, both static and mobile, and from conveyors.

Research related to the safe operation of hydraulic fluid and compressed air apparatus, particularly very high-pressure apparatus.

Improved techniques to afford suitable protection against the possibility of potential hazards external to the working encroaching into the workings.

Improving the safety aspects of lighting and visibility.

A study to develop a mineral winning strategy taking full account

of all working interactions and the ventilation system layout.

Study of vibration reduction in the machinery used.

Study of ventilation- and cooling-related safety factors in hot workings.

j) Rock outbursts, associated phenomena and instantaneous gas outbursts.

This is a newly designated field to emphasize the importance attached to it. In any project undertaken particular attention should be paid to work in this field being done elsewhere, both inside and outside the Community.

Work in this field would look at aspects of spontaneous strata movement phenomena associated with mining and the prediction and prevention of these. Measurement, monitoring and presentation of information should be studied and computer techniques should be developed to give advance warning of such events.

Prevention techniques will be developed for workings susceptible to instantaneous gas outbursts, as will rescue and work-force withdrawal methods specific to workings of this type.

k) Surface.

This is a new, separate field of research to direct attention to working methods at the surfaces of underground mines and also at opencast mining operations. As underground, operations are becoming increasingly technical,complex and more difficult to

control and special attention should be paid to the safety aspects when new equipment, methods and systems are introduced.

The following are considered worthy of study:

The safer operation of mobile equipment.

The operation and control of beneficiation plants, with particular emphasis on automatic and computer control and on the hazards to safety which may arise.

Man-riding and the handling of materials and equipment.

Assessment of the stability of materials and structures and the development of test methods for identifying weaknesses.

The safety aspects of noise, lighting and communication.

Study of slope stability.

III. UNDERTAKING OF RESEARCH WORK

The research work under the programme would, in general, be undertaken by the mining research institutes in the countries of the Community. These institutes have, over many years, undertaken research into mine safety, carried out the work under the programme now terminating, and are fully capable of doing any work proposed by this safety programme. Research would be allocated to the institutes according to their particular facilities and general direction of research, so that the programme would be completed in the most efficient and beneficial manner.

IV. PROCEDURES

After a research programme proposed by the Commission has been approved by the Consultative Committee of the European Coal and Steel Community and has received the assent of the Council of the European Communities, the necessary executive and consultative procedures are adopted by the Commission to establish and ensure fulfilment of the programme.

Three advisory committees - the Research Committee, the Committee of Producers and Workers on Industrial Safety and Medicine and the Committee of Government Experts - offer pertinent advice to the executive when projects are being considered.

On acceptance of a research project by the Commission, it is controlled by a contract detailing all requirements, including submission of periodic and final technical reports. These are looked at by experts committees whose members have specialized knowledge which enables them to offer relevant advice on the progress and results of the research. The number of committees and number of members are kept to a satisfactory minimum.

This control system has worked well with previous research programmes and it is proposed that it be used for this safety programme.

V. RESULTS OF RESEARCH

It is essential that all details and results of research are made known to all interested bodies. By the procedure described

above information on research is disseminated through the members of the committees of experts, members receiving, with minimum delay, all technical reports falling within the ambit of their particular committee. In this way information is made available to the mining industries in the member countries of the Community with minimum delay.

For wider dissemination, information on research being undertaken, results of research and patents arising are contained in abstracts published and distributed by the Commission. It will, however, continue actively to seek improved methods for the dissemination of the information constituted by the results of work included in this research programme. In addition, any person or body requiring fuller information may, on request, obtain complete reports on any aided research. Also, during the lifetime of a programme, a full report detailing projects, findings and other relevant information is published and distributed.

These methods, which have been developed and refined over the years, have proved satisfactory and it is proposed that similar methods be applied to this mines safety programme.

VI. FINANCIAL ASPECTS AND DURATION OF PROGRAMME

A programme of safety research, as with any research programme, should be of sufficient duration to allow tangible results to be achieved and as short as possible to enable the benefits arising from the results to be implemented practically with minimum delay.

Past experience has shown that in general a programme of 5 years' duration is satisfactory and this period is proposed for the programme, to become operative in 1982. In general, research projects included in the programme would be of two or three years' duration.

From experience, particularly that gained during the course of the first mine safety research programme financially aided by the Community, a reasonable estimate can be made of the financial aid required.

Financial aid from the Community can be a maximum of 75% of the total costs of a research project, the beneficiary meeting the remainder. Over the years the cost of research has increased and in arriving at a factual costing the possibility of a continuation of this trend over the next few years must be borne in mind. Many of the institutes already possess the facilities needed for further research and to minimize cost it is imperative that the research work is correctly distributed so as to maximize the use of existing facilities.

In addition to the direct aid costs, sufficient funds should be made available to finance programme running costs.

Such costs comprise those for the holding of related, necessary meetings, travelling and subsistence allowances for experts and research workers, the organization and operation of study or information seminars and the publishing and dissemination of the results of the research undertaken.

Considering all these aspects, total financial aid of 12 500 000 European Units of Account over a period of 5 years is considered necessary, to give a suitable programme which would

contribute substantially towards increased safety in mines.

VII. CONCLUSIONS

The Commission of the European Communities,

- considering the need to promote safety in mines;
- taking account of the favourable opinions and full agreement of the professional, governmental and scientific advisory committees, and of the statements of intended research made by the specialized institutes and bodies consulted;
- having regard to Article 55 of the European Coal and Steel Community Treaty;
- Proposes
- to assign 12 500 000 European Units of Account for the realization, over a period of five years commencing in 1982, of a research programme 'Safety in Mining'.