

# COMMISSION OF THE EUROPEAN COMMUNITIES

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## MEMORANDUM

Establishment of a Research Programme  
"Industrial Hygiene in Mines"

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## ESTABLISHMENT OF A RESEARCH PROGRAMME

## "INDUSTRIAL HYGIENE IN MINES"

## I. INTRODUCTION

Since 1957 three research programmes related to dust control and health in mines have been implemented in pursuance of Article 55 of the European Coal and Steel Community Treaty. These programmes have had total credit of 12,900,000 units of account, the Third Programme, "Health in Mines", having credit of 5.0 millions units of account over five years, commencing in 1971. The credit allocated to the Third Programme has been exhausted in giving aid to ninety two research projects.

The protection of the health of miners in the coal and ironstone mines and the amelioration of their working conditions are continuing commitments and it is proposed that a further research programme, "Industrial Hygiene in Mines" be instituted with a credit of 7,000,000 European Units of Account (E.U.A.) for a period of five years.

It is intended that studies in the Programme will relate essentially to matters concerning dust and noxious gases but some attention will also be given to problems of noise, visibility and climate.

## II. PREVIOUS RESEARCH

Bearing in mind the pneumoconiosis problem in mining the research hitherto has considered essentially all aspects of the prevention of this disease and in addition the problems posed by mine air pollutants other than dust, notably those arising from the use of diesel powered machinery and explosives underground.

The three main areas of research encompassed by the three programmes have been:

1. Technical methods of environmental control

2. Monitoring of the environment.
3. The relationship between environmental factors and health.

Valuable progress has been made from the research projects undertaken and a considerable amount of the knowledge gained from them has already had practical application in the coal and iron-ore mines of the Community. In the Third Programme, many of the projects of which are still going on, the three main fields embraced were those detailed above and the following gives information on some of the projects conducted in those fields.

#### 1. Technical methods of environmental control

Technical developments have necessitated adapting existing methods of dust control to meet the demands posed by the new, more difficult conditions and the development and testing of new control methods to meet the ever more demanding new machinery and methods of exploitation.

Much has been learned about the factors affecting the production of dust and its dispersal into the mine ventilation. This has led to improvements in the design and operation of winning machines, particularly involving reduced numbers of cutting picks on drums and discs and reduction in pick speeds, and in the application of processes to effect improved dust prevention and suppression.

High efficiency dust collectors have been successfully developed for drivages and experimental systems for face machines have achieved tangible success.

Results have been encouraging in the study of air curtain technology to provide an enclosed area of acceptable conditions and also to facilitate dust extraction. Success has also been achieved in dust control by the use of more conventional screening measures.

The study of dust formation and its reduction in face workings during the movement of powered face supports has resulted in the use of plastic sheeting between the support canopies and the roof and the development of water powered extractors between canopies to entrain dust and deposit it in the waste.

Dust control at underground coal breakers also received attention and it has been shown that adequate screening and automatic water spray application can ameliorate conditions. Tests showed that the varying power consumption of the breaker is the most suitable factor to regulate water spraying.

A wider knowledge has been gained of the application of water infusion and the use of additives both for water infusion and direct application with dust suppression water. Results achieved with additives have been variable but improvements in dust conditions have been noted in cases where used in connection with infusion, plough track spraying and mineral transportation.

Infusion processes were developed for the working of thick seams with emphasis on minimum maintenance and supervision and monitoring of the operation. Studies have also been undertaken to determine the movement and distribution of the water in the coal seam and to try to predict the effectiveness of infusion. A comprehensive manual on water infusion was produced.

To achieve more effective dilution of dust and fumes improved ventilation was obtained in the Lorraine iron-ore mines by the drilling of large diameter bore holes. After initial pilot boring of 400 mm diameter, raise boring, 3.6 m diameter, was done in 13 holes over a period of three years. Inspection of the holes is done by a magnetoscopic film camera suspended in the shafts, thus obviating the necessity for persons to be in them.

## 2. Monitoring of the environment

Research has shown the value of gravimetric sampling as a reliable and accurate technique and the selective gravimetric sampling of respirable dust is now accepted as the standard method of measurement in British, French and German coal mines. In Belgium gravimetric measurement of total dust is used. Continuous shift-length sampling at fixed points is also in general use. Thus comparisons between the different countries are now easier to undertake and a current joint research is comparing assessments of dustiness on coal faces in the four countries using the different national sampling instruments and methods of sampling and evaluation.

Dust surveillance procedures using both static and personal samplers have been studied with a view to securing the efficient and economical coverage of all workplaces.

There is complete agreement on the need to be able to continuously indicate and/or record airborne dust conditions as an aid to dust control and to this end research has been devoted to instrument design and development. Several prototypes of one instrument developed, having such facilities and also the facility to telemeter the information, are being evaluated in mines throughout the Community.

Research has commenced on the problem of measuring the larger inhaled dust particles.

During the course of the Third Programme a method of measuring full shift exposures to nitrous fumes has been developed for coal mining use. This is achieved through the use of an attachment to a dust sampler so that both gas and dust are sampled together.

### 3. Environmental factors and health

Epidemiological studies in the mining countries of the Community have shown essentially similar relationships between pneumoconiosis risk and respirable dust concentration but there exist important differences in the pneumoconiosis risk between collieries and coal fields, due apparently to differences in the specific toxicity of the dusts. These differences cannot yet be explained in terms of the quartz and other mineralogical components of the dust. A four nation project to examine relationships between epidemiological findings and dust toxicity is currently being pursued.

Research has been undertaken in the field of air pollution by diesel vehicles and shot-firing underground. In the iron-stone mines of France this has led to the use of diesel engines emitting less pollutants and current research relates to the possible use of turbines underground and the study of soot in the fumes from diesel engines.

Noise has recently assumed increased importance in connection with occupational health and research is being undertaken to assess noise levels and draw up a noise plan for an iron-stone mine with a view to effecting the attenuations shown to be necessary. This work complements the comprehensive list of projects relating to noise being done in the Ergonomics Research Programme.

### III. ASSOCIATED ACTIVITIES

In addition to this research on dust control and health in mines the Community aids research relating to safety in mines, a new Community Programme, "Safety in Mines", being established in 1976 with credit of 7.5 millions E.U.A. over five years. Also, in the field of industrial health and safety the Community has programmes on "Ergonomics", "Chronic Respiratory Diseases" and "Pollution Control in the Iron and Steel Industries".

In addition to research of a social nature coming under the Directorate-General for Employment and Social Affairs, Direction "Coal"

of Directorate-General "Energy" financially aids technical and economic research relating to coal and iron-ore mining, account being taken of health and safety matters associated with the research. Also, the Directorate-General "Research, Science and Education" has a comprehensive research programme concerning the environment and this contains matters which relate closely to industrial hygiene.

To effect satisfactory research in all these fields entails close co-operation between all the relevant disciplines and in the formation of a new programme due account will have to be taken of the research done and being done in the other programmes. Particularly close co-operation will be necessary when different disciplines are touching on the same subject, both in the preparation and the execution of a new programme for mines.

#### IV. THE PROGRAMME

##### 1. General

The Third Programme related research requirements to the realities of operating techniques and production envisaging a continuation of increased mechanisation, concentration of production in fewer producing units and maximisation of shift and daily outputs from the units of production.

In general these expected developments have materialised bringing attendant difficulties for the working environment. No doubt their effects will continue to be felt during the period of any new programme, and this, together with further developments in the same direction and further normal technical progress will make the desired working environment more difficult to maintain and improve.

That there will be a need to maintain and indeed improve the mining working environment is indisputable. Bearing in mind the current and projected energy situation, which demands maximum use of the Communities' indigenous fuel supplies, it will be necessary to make the mining industry as safe and healthy as possible in order to attract the necessary recruits and to retain its personnel. Furthermore, natural social pressures will, rightly, demand ever improving standards and conditions, related to research findings, in the working environment and this no more so than in the coal and iron-ore mining industries.

As research progresses and the answers to some problems are found doors are opened to other problems requiring solution. No result is inviolable and there may arise the necessity for modification in the light of changing circumstances. For instance initial research in relation to airborne dust was directed towards protection against silicosis which, in turn,

was followed by research directed towards protection against mixed dust pneumoconiosis. Now the stage has been reached to consider pneumoconiosis and other dust related diseases.

Recent research is showing that in coal mines the influence of quartz in the development of mixed dust pneumoconiosis may not be as previously hypothesised and that possibly larger sized airborne particles, not normally considered in the context of pneumoconiosis, may relate to other diseases such as bronchitis and emphysema.

Thus research is a continuing process and the points outlined illustrate the need for further research in the field of health in mines.

It is necessary to ensure that the requisite health factors receive consideration from the outset and are inbuilt with new machinery, systems and methods. In particular the likely effects resulting from the use of new substances underground should not be overlooked. A new programme should be instituted and should, in general, be based on the same three broad fields as the last one. The predominantly pneumoconiosis orientated research should be broadened, although still concentrating essentially on this disease, to include studies bearing on other diseases which may be inter-related both from the disease and the dust aspects. In particular the interplay between the mining noxious gases and dusts and the bearing of the existence of the two on the incidence of the related diseases should be considered. Research into noise, visibility and climate should also be considered.

Any research undertaken must be relevant to the needs of the coal and iron mining industries and give results capable of successful practical application in as short a time as possible. Practical application is vital and must be effected with minimum delay.

In defining the research aims of a programme due account will have to be taken of related research, both within and outside the Commission, to ensure maximum co-ordination between different programmes and that at the end of the day maximum benefit has been derived from the money and effort expended.

One particular facet of the Third Research Programme was the introduction of joint projects whereby a project was researched together by several institutes in the same or different countries and co-ordinated by a project leader. This approach should be developed as much as possible as it is felt that a multi-national joint approach to a common problem, particularly in the field of industrial health, can repay far more than several individual researches pursued by member countries.



## 2. Contents of Programme

It is proposed that a new programme should continue research in the direction already taken by the previous one, pursue logical consequences arising from this and commence new research considered desirable and relating to the three main fields of research.

The following indicates these main fields and under each is shown pertinent research projects which, although by no means exhaustive, should most certainly be considered. At the same time the approach should be sufficiently broad to allow the inclusion of other topics as considered necessary.

### (a) Technical methods of environmental control

Under this main heading would be included all research relating to technical methods of controlling the environment and in particular should include:

Research into the effects of new machines and techniques on the make of dust and other pollutants and the reduction of make by improvements in machine design and techniques.

Research into the improvement of dust collecting techniques, in particular extraction units, as this seems a particularly fertile field. The aim would be to develop more compact and efficient units and these may be of varying types as at present no particular type seems likely to provide a universal solution.

Research into air curtain technology with emphasis on developing and perfecting techniques to provide a fresh air environment for workmen and an enclosure within which to practise dust control. Also the use of thermal convection air currents for the dilution of dusts and gases.

Research into the design parameters for powered supports, to minimise make of dust in connection with their function underground, and into improvement of the methods of dealing with dust created.

Further studies of the relationship between dust and mine climate with particular reference to the pattern of deposition and the granulometry of airborne dust.

Studies to effect ever more efficient wet suppression systems as this remains, and is likely to remain, the principal suppression method. Further research into the use of additives for dust control purposes in terms of wetting, binding and evaporation retardant capacities.

Further research into water infusion related essentially to the need for automation and remote monitoring of the technique and to the monitoring of the water in the strata.

Research into the design and development of individual protection to give an unpolluted working atmosphere.

In all the researches due attention should be paid to the effects of proposals on other aspects of the working environment not specifically related to the proposal.

(b) Monitoring the environment

Research should be pursued to ensure that the measurement of dust in the various countries of the Community can be related reliably one to the other with the goal of general agreement on dust standards, both in terms of concentration and mineral composition, and the measurement of dust. To achieve this greater knowledge of dust formation and deposition related to time and location will be necessary.

Under this broad heading the following should be pursued:

The development and improvement of dust sampling instruments and analytical methods for determining chemical, physical and mineral properties of the mining atmosphere.

The design and development of instruments for continuously recording and indicating dust levels, and also for instantaneous short-term measurement purposes. There should be full development of automated measuring stations with telemetering and data processing facilities.

The development of optimum dust sampling strategies to provide information on dust conditions at workplaces throughout the mine so that dust control effort and personnel deployment can be appropriately directed.

The development of instrumentation for measuring other air contaminants, including airborne radioactive materials and with particular emphasis on further development of measuring techniques for nitrous fumes.

(c) Environmental factors and health

Under this heading it is foreseen that a considerable amount of research may emerge.

In particular, the following should be undertaken:

Further studies to try to determine safe dust limits for the employment of persons with early signs of pneumoconiosis.

Research into the specific harmfulness of dusts, involving epidemiological and laboratory studies, to enable levels for airborne dust to be expressed in terms of the actual health hazard involved.

Further research into the effects on health of fumes and noxious gases arising from the use of diesel engines and explosives including synergistic effects with dust in pneumoconiosis and bronchitis.

Studies relating to individual susceptibility to dust and other pollutants.

Research to ensure comparability of the qualitative and quantitative measure of dust concentrations and the uniform radiological assessment of pneumoconiosis throughout the Community, the latter part of the research being undertaken in the medical programme on chronic respiratory diseases.

Studies of new materials in order to assess the health danger which may arise in their use in the mining situation.

Furthermore, as indicated in the introduction, research into the problems of noise, visibility and climate where they constitute a health risk, are considered desirable.

In this section in particular due regard will have to be paid to the necessary multi-disciplinary studies, and to full co-operation and co-ordination of the work undertaken to ensure that the desired results are achieved.

#### V. UNDERTAKING OF RESEARCH WORK

The research work under the programme would, in general, be undertaken by the mining research establishments in the Community. These institutes have, for the most part, already undertaken Community sponsored research as well as being employed regularly on nationally sponsored work. To enable effective use of resources and the programme to be satisfactorily accomplished, research should be allocated in the way best suited to the facilities and general research direction of the various institutes.

## VI. PROCEDURES

After acceptance, previous programmes have been controlled in a manner which has proved generally satisfactory. Three advisory committees, a Research Committee, the Committee of Producers and Workers on Industrial Safety and Medicine and the Committee of Government Experts, composed of members having the relevant expertise, offer pertinent advice to the Commission when projects are being considered for financial aid.

On acceptance of a project by the Commission it is controlled by a contract, binding the beneficiary and the Commission, which details requirements including the provision of technical reports relating to the research. These are examined and discussed by relevant groups of experts who meet and offer pertinent advice to the Commission. On occasions, as necessary, these groups meet at the various research centres or mines where research is being done so that they can examine and evaluate at first hand the research on which they advise.

It is proposed that a new programme would be controlled in this way.

## VII. RESEARCH RESULTS

Details of research and results achieved should be made known to all interested parties. By the procedures described above the research reports are made known to members of the groups of experts without delay. The experts are all drawn from the mining industries of the Community countries so that research results are made known to these industries.

For wider dissemination of information on the research undertaken precise details of research accorded financial aid are contained in Euro Abstracts and precise final reports on projects are included as they become available together with any patents arising from the research. In addition any person or body requiring a complete final report may have it on request.

During the life of a programme a report detailing projects and progress is also published and distributed.

Methods to improve dissemination of information are always being sought but it is thought that the system described should operate satisfactorily and this will be used for any new programme. Improvements within the framework will

continue to be sought to try to make information on the research as widely known as possible.

The Mines Safety and Health Commission operates in the field of safety and health by way of exchange of experiences between the Member States. The Commission's mandate enables it to propose research and from available information make proposals relating to health and safety in mines. The results of all pertinent research are brought to the notice of the Commission.

#### VIII. FINANCIAL ASPECTS AND DURATION OF PROGRAMME

Previous programmes, in the fields of both health and safety, have been of five years' duration. This period has proved of sufficient duration to enable tangible findings to emerge from research and not too long from the point of application of results to the practical situation. In general projects have been of two and sometimes three years' duration and this too would be applied within the concept of an overall programme duration of five years, this being the proposed duration.

In arriving at a costing for a programme, this including financial aid and subsidiary expenses associated with running the Programme and disseminating results, extending over the next five years due account has been taken of the costs of research previously undertaken, the pattern of rising costs, the annual budget allocated for research of a social nature in the coal and steel sector and the staffing available and needed to adequately administer such a programme.

Taking into account these factors, and that aid accorded by the Community can be a maximum of 75% of the total costs of a project, the beneficiary financing the remainder, it is considered that, to give a satisfactory programme which would contribute substantially towards improved environmental conditions in mines, a total financial aid of 7,000,000 European Units of Account over the period of five years, commencing in 1977, would be necessary.

#### IX. CONCLUSIONS

The Commission of the European Communities,

- considering the need to promote research relating to industrial hygiene in mines;

- taking account of the favourable opinions and expressed agreement, as well as their views on research, of the professional, governmental and scientific consultative committees consulted;
- considering Article 55 of the European Coal and Steel Community Treaty;

Proposes:

- to assign 7,000,000 European Units of Account for a period of five years commencing 1977 for a Research Programme "Industrial Hygiene in Mines".