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Safety in mines and the role of training[1]

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Introduction

From earliest times the mining industry has suffered disasters in which men have been killed or injured and serious material damage has been caused. Mining authorities have consequently long endeavoured, together with the operators, workers' representatives, occupational safety services and research institutes, to protect the miner at the workplace and to make every process and item of equipment reasonably safe.

However, despite all the efforts that have been made in this field, not only on the national plane by the public authorities and the social partners but also internationally by organisations such as the ILO, the Commission of the European Communities and the Council for Mutual Economic Assistance, and despite collaboration between European and American mining research institutes in the framework of the programmes launched by the United Nations Institute for Training and Research, it has not been possible up to now to eliminate entirely the risks inherent in the nature and techniques of mining and quarrying. Since, furthermore, these techniques are subject to constant changes they are always posing fresh problems for mining personnel and continuously confronting them with new tasks. It is not only the major disasters which are so worrying but also isolated accidents. The accompanying table gives figures on accidents at work in the mining industries of Belgium, France, the Federal Republic of Germany, Italy and the Netherlands. It will be seen that, despite some improvement as regards the frequency of fatalities, the number of accidents remains at an alarmingly high level. The same is true of occupational diseases, with pneumoconioses heading the list. To cite only the figures relating to the coal industry in the United Kingdom, there were at least 2,270 deaths from pneumoconiosis during the four years 1975-78.[2]

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Year	Production (thousand tons)[1]	Hours worked (millions)	Fatalities	Persons seriously injured[2]	Fatalities per million tons	Persons seriously injured[2] per million tons	Fatalities per million hours	Persons seriously injured[2] per million hours
1970	170 355	438	188	6 591	1.104	38.69	0.429	15.048
1971	164 910	414	182	6 249	1.104	37.89	0.440	15.094
1972	146 008	369	147	5 763	1.007	39.47	0.398	15.618
1973	139 700	332	137	5 560	0.981	39.80	0.413	16.747
1974	133 300	313	143	5 054	1.073	37.91	0.457	16.150
1975	129 100	319	110	4 795	0.852	37.14	0.345	15.031
1976	125 600	301	125	4 791	0.995	38.14	0.415	15.917
1977	119 670	284	83	4 357	0.694	36.41	0.292	15.342
1978	116 383	270	95	4 443	0.816	38.18	0.352	16.456

[1] Net production including slurry and dust. [2] Persons incapacitated for eight weeks or more.

Source: Commission of the European Communities: *16th Report of the Safety and Health Commission for the Mini and Extractive Industries, Year 1978* (Luxembourg, 1980; doc. 3827/1/79E).

National and international bodies and experts concerned with occupational safety in mines and quarries are fully aware of the magnitude of the task confronting them. Safety services or committees are constantly being developed or expanded in almost all coalfields and neither side of industry needs convincing of the absolute necessity of safety at work: each knows that safety is an essential factor in improving working conditions and should be central to everything that has to do with production and its organisation. While this view is no more than one would expect of the workers' representatives, it is also shared by the employers and governments, not only for moral reasons but also because they are painfully aware of the increasing burden which occupational accidents impose on the undertakings and the entire national economy.

In many countries in which the extractive industries hold an important place (France, the Federal Republic of Germany, the USSR and the United Kingdom, for example), all the parties concerned are carrying out research aimed at reducing, if not eliminating, accidents in mines and many experts believe that one of the first steps to be taken is to provide the workforce with training in occupational safety.[3] While we are fully convinced of the necessity and beneficial influence of such training in the fight to improve safety, we feel that it can only be fully effective if certain general criteria and others relating more specifically to the undertaking are satisfied; consequently, before tackling the subject of training itself, we shall discuss those factors which appear to us to be necessary, if not sufficient, conditions for making real progress in this field.

The role of the authorities

It seems necessary first of all to set up an official administration responsible for various regulatory inspection and research functions concerned with mining and quarrying work.

Regulations and inspection

The first duties of such an administration should be:

(a) to draw up general regulations prescribing the measures necessary for the safety of the workers; and

(b) to make sure that these general regulations are observed.

It should be given sufficient means to carry out these tasks, in the form of both personnel (technical inspectors) and legal powers.

Its officers should be not only competent but also independent of the employers and the trade unions alike. In the senior posts at least, they should have the expertise enabling them to keep abreast of technical and scientific developments. On the legal plane they should have the powers needed to enforce compliance with the regulations.

Services of this type have been set up and are functioning in a number of countries (e.g., France, the Federal Republic of Germany, the USSR, the United Kingdom and the United States).

Apart from drawing up regulations and supervising their application, the official administration responsible for mines should monitor the introduction of new machines and processes in mines and quarries. After all, it has to be recognised that frequently the main object of innovations is to increase the return on invested capital and that sufficient account is not always taken of the need to improve safety at the design stage. Innovations should be subjected to rigorous scrutiny (including ergonomic studies conducted by experts) and, if need be, undergo a trial period. Where necessary, improvements or modifications would be required. A body comprising representatives of employers, workers and the mines administration would be called upon to give its considered opinion. In this way new machines could not be used until a certificate of approval had been issued in accordance with a prescribed procedure.

Research

Because the frequency and seriousness of accidents are increasing in certain industries, a trend that in some countries can also be noted in mines and quarries, some people lay the blame on technical progress. We do not feel this is fair: innovations stand or fall by the use which is made of them. If one put as much effort into improving safety as into increasing productivity there is no doubt that substantial progress would be achieved in this

field as well. However, since the return on improved safety appears less immediate than that on increased productivity, it is the authorities which must take the initiative.

Hence the need to set up bodies specialising in applied research in the field of mining and quarrying under the control of the official administration responsible for these industries. Using the latest scientific techniques these bodies would carry out research into the main fields of mining safety (firedamp control, combating harmful dusts and gases, ergonomic studies of machines and workposts, individual protective equipment, etc.). They would have local sub-branches which would inform the undertakings of the results of this research and be informed in turn of new problems encountered by the undertakings. In this way technical progress would be placed at the service of the miner rather than vice versa, as sometimes appears to be the case.

An example of the form this can take in a particular country is the extensive research network that has been set up in the USSR since 1950. At the moment there are 25 institutes carrying out research into safety, health and rescue work in mines and quarries. The Ministry of the Coal Industry alone possesses 12 such institutes, i.e. at least one in each coalfield; the others come under various ministries, including Public Health. In 1978 more than 150 research projects were undertaken and 56 of these resulted in practical applications in coal mines. In 1976-80 the Ministry of the Coal Industry's five-year budget for research into safety and health in mines amounted to some US $35 million.

Very large sums have also been devoted to safety research in this field in other countries such as Belgium, France, the Federal Republic of Germany, the United Kingdom and the United States.

At the international level attention should be drawn to the close co-operation established, within the framework of the research programmes launched by the Commission of the European Communities, between various scientific bodies: CERCHAR (France), Bergbau-Forschung GmbH (Federal Republic of Germany), the Institute of Occupational Medicine/ National Coal Board (United Kingdom), and the Institut d'hygiène des mines (Belgium). Under the third programme of research financed by the European Community and entitled "Health in Mines" (1971-76), ten institutes in Belgium, France, the Federal Republic of Germany, the Netherlands and the United Kingdom co-operated in 92 research projects covering various aspects of occupational safety and health in mines and quarries.[4]

The role of automation

Safety can also be greatly improved by automating the operations in which human error is frequently the cause of accidents. With modern technology a very high degree of reliability can be achieved in this field.

An example of what can be done is the automation of the main haulage system introduced a few years ago in a large mine in the Ruhr. The system at present comprises 20 kilometres of double-track galleries, 46 points and 41 routes with a network of highly complex track junctions through which the trains pass under completely automated control.

Obviously, the supervisors had to be given additional training and information regarding safety in the galleries served by the automated vehicles, but the important thing is that the hoped-for results were achieved: in ten years of operating not a single accident was recorded, whereas during the same period there were 22 serious and 6 fatal accidents in the areas served by manually controlled locomotives. Similarly, each year there were on average 125 derailments and one collision in the manually controlled system, while in the automated system there were no collisions at all and only three derailments in ten years. This clearly shows how automation of the haulage system has led to safer working conditions and equipment.

The same result was noted following the automation of remote-controlled belt-conveyors and hopper traps in coal mines in the United Kingdom.

Safety and health bodies

The efforts of the official mines administration, and even the most advanced research and the automation of certain operations, will count for little unless all the institutional elements which go to make up the safety system in a modern mine or quarry function efficiently. Let us briefly examine the role of each of these.

The workers' safety delegate

This should be an experienced worker with a thorough knowledge of the jobs he is to supervise. The manner in which he is designated will naturally depend on the applicable legislation; however, whether elected by workers or appointed by management, he must in any case be accepted by his workmates since he needs a certain moral authority if he is to be effective. He must also be completely familiar with the mining regulations and receive safety training on a continuing basis.

Where he is elected by his workmates, he should have a fairly exalted idea of his duties: this will ensure that he does not resort to demagoguery to keep his post. He should consider himself an essential cog in the safety system and consequently co-operate actively with the management by drawing its attention to all bad working conditions while taking care not to exaggerate them in any way since his advice and warnings would then lose any power of persuasion vis-à-vis the employer.

His role in the training of his fellow-workers is very important. First of all he must act as a persuader: after undergoing training himself he must persuade his workmates to attend the occupational safety and health courses. Next, his extensive knowledge of safety matters will set the workers a good example to follow.

To sum up, this is an essential post to which the incumbent must bring dedication and a great many other qualities.

The mine safety service

The functions of this service are twofold. On the one hand, it must liaise between the undertaking and the local branch of the mining authority, compile accident statistics, disseminate the mining regulations in the undertaking and reply to the management's requests for information. This is the routine side of its work. On the other hand, it must play an active and dynamic role in safety activities themselves. Its personnel must monitor safety conditions on all worksites and in all operations. Using scientific methods of analysis they will isolate the causes of accidents and pass on their findings to the production chiefs.

The choice of the head of the service and his staff is crucial. They must be thoroughly familiar with production problems and the organisation of work as well as the regulations in force. Since they will be expected to engage in a great deal of physical activity it is vital that this service should not be considered a "siding" into which tired workers quietly awaiting their retirement can be shunted.

It hardly needs to be added that the technical or even the general management has a duty to support the activities of this service since, when all is said and done, responsibility for the workers' safety lies with the top level of the undertaking's hierarchy.

The safety and health committee

Like the workers' safety delegate and the mine safety service, this committee has an extremely important role to play. It is composed of representatives of the employer and the workers and it is the principal arena in which the two sides come together to discuss safety questions. However, its activities should also be followed very closely by the local representatives of the mining administration, who will thereby be kept informed of safety problems facing the undertaking and of the general atmosphere prevailing in it.

All accidents of a serious nature should be investigated by the committee and the findings communicated to the workforce (staff information). If the conclusions point to the need for a particular course of action, its implementation must be followed up at subsequent sessions of the committee.

The committee should hold in-depth discussions on the introduction of new machines and processes and in particular see to it that equipment manufacturers take account of the improvements decided upon and requested. It should be kept informed of any new regulation as well as of serious accidents occurring in other mines. News of its discussions and activities should be widely circulated among the workforce.

Safety training

While the conditions briefly described above are necessary they are not sufficient.

Regulations alone cannot significantly improve safety. The possible causes of an occupational accident are very numerous and complex and no regulation, however well drafted it may be, can cover all of them.

As for research into improving safety, this will have hardly any impact unless the general level of safety-consciousness is raised. Yet the fact is that while the over-all frequency of occupational accidents is high, to the individual worker the risk appears very slight: the mere risk of an accident is not sufficient to make workers obey the safety instructions. The moral of all this is that if hazards are to be effectively controlled it is essential to provide the workforce with permanent training.

However, is it only the rank and file who should be trained, and how is one to go about it? We shall now attempt to answer these two questions.

Who should be trained?

To this question there is in our view one very simple answer: workers of all occupational categories, whatever their duties, should receive safety training; in other words, such training should be given to all levels of the hierarchy.

That rank-and-file workers should be trained is universally accepted since they are the ones directly affected by accidents. They suffer physically, financially and socially. Their daily exposure to risks should make them prime specialists on the subject. In addition, as we have already pointed out, the apparent cost of preventive measures often leads to safety being sacrificed to considerations of short-term financial gain. To be sure, safety matters are likely to be taken more seriously if there are committees or similar bodies on which the workers serve. This is why the setting up of a safety and health committee seems to us to be essential. However, if the discussions between management and workers are to bear fruit, each side should have members capable of marshalling cogent criticisms and proposing sensible solutions. It is essential, therefore, to train the workers to enable them to participate in the preparation and implementation of a safety policy—which concerns them more than anyone else. It is certain

that any programme in this field will have a much better chance of producing results if the workers participate actively in it than if it appears to be imposed on them by management.

But this still does not go far enough because, as we have said, safety training should cover all occupational categories, hence also the general management and the engineers in charge of production and the "functional" units (research, work organisation, and, above all, safety). This issue is sometimes dodged, and a few words of explanation seem to be called for.

Current research on occupational accidents shows that their causes are generally complex. Systems theory has been invoked to demonstrate that accidents are, first, the immediate or more distant consequence of an interaction occurring in the system's operation; secondly, they are a symptom of a dysfunction of the system.

Now the causes of dysfunctions in the system represented by a mine can be many, arising at the level of the undertaking (for example, an administrative structure ill-adapted to the functional units), of the work crew (such as insufficient dissemination of information within the group) or of a particular department (such as an unsuitable distribution of tasks). These causes of dysfunction concern either the general management, as regards the structure of the mine, or the production engineers, as regards the organisation of work.

It is therefore essential that the general management staff as well as the engineers in the production departments and in the various functional units should have a sound knowledge of accident theory. With proper safety training they will be in a much better position to analyse the situation and carry out effective preventive work.

Finally, participation in safety training by the director of the mine in person and his senior aides will demonstrate the importance which the general management attaches to it and will have a positive influence on the entire staff.

How should training be carried out?

Three rules can be laid down for the provision of safety training: it must be given by experts; it must be a continuous and long-term process; and both the content and the techniques used to put it across must be differentiated.

Training should be provided by experts

An occupational accident, as we have already pointed out, is an extremely complex phenomenon; it results from a combination of circumstances and is practically never attributable to any one cause. The numerous factors involved can be of a psychological, physiological,

technical or sociological nature. Only experts trained in the appropriate disciplines—psychology, industrial physiology, ergonomics, sociology and education—will be able to make a valid analysis of the situation in the mine from the point of view of occupational safety and formulate appropriate recommendations for launching a safety campaign.

This naturally does not mean that these experts should work in a vacuum; on the contrary, they will only be able to do their job effectively with the assistance and participation of the entire workforce. But it is essential to understand that safety training must be based on a thorough knowledge of the problems involved and should not be entrusted to amateurs.

Safety training is a continuing and long-term process

It is bound to be long term because its purpose is nothing less than to change the mentality and behaviour of all categories of workers. True safety training is not something that can be achieved overnight as if by waving a magic wand. It has to start at the top with management, then be carried on down through the instructors and trade union representatives. Finally, after a meticulous analysis of the situation, an accident prevention campaign, or more probably a series of such campaigns, will have to be launched aimed at the workforce as a whole.

Safety training is furthermore a continuing activity. Over time, interest in safety practices wanes and the principles themselves are forgotten. Accordingly, all workers should be retrained from time to time, particularly since the problems may have changed and the situation altered. Moreover, there is always room for progress. Training must therefore be envisaged as an activity to be carried on unceasingly and one which will evolve over time.

Although it will necessarily be launched with much beating of drums, a safety training campaign will gradually develop into an almost imperceptible but constant activity. And because of this need for continuity, a great deal of imagination and ingenuity will be called for in finding new themes in order to avoid boring the target audience. The campaign should therefore be given a periodic facelift. This will not be easy since nothing is simple in the field of occupational safety, and will require much perseverance and alertness on the part of those in charge.

Training courses and techniques should be differentiated

Because the various categories of mineworkers have different functions, different training backgrounds and different specialisations, the training programmes will have to be adapted to each of them. In the following section we shall briefly discuss how these programmes should be designed in each case.

Safety training programmes

Programmes for the general management, senior managerial staff and engineers

At this level the training programmes will be based on a systems approach. For further details the reader is referred to the authoritative work on the subject by Leplat and Cuny;[5] we shall limit ourselves here to summarising it briefly.

The systems concept is fundamental since it will bring home to the general and senior management how complex the whole question is. It will make them abandon the idea that an accident has only one cause; it will convince them of the folly of adopting piecemeal measures and of the need to take an over-all view of the problem.

According to this concept an accident is only the particular symptom of often repetitive incidents (dysfunction), attention to which will improve safety. Investigations should be made into the causes of this dysfunction:

(a) at the level of the mine itself: administrative structure ill-adapted to the functional units, insufficient co-ordination of activities and communications problems;

(b) at the level of particular departments: unsuitable distribution of tasks, inappropriate rules governing job assignments and functional instability;

(c) at the level of the work team: poor dissemination of information within the group and lack of cohesiveness in the team;

(d) at the level of the job: causes inherent in the equipment (signals, controls, signal/control coupling, wear and tear); those attributable to the organisation of the work (time constraints, excessive workloads, conflict between productivity and safety, harmful influence of secondary tasks on safety); causes inherent in the environmental conditions (noise and masking of signals, lighting deficiencies); and the personal characteristics of the worker (visual acuity, adaptability, age, perceptions and attitudes, fatigue, alcoholism).

The object of in-depth analysis of these causes of dysfunction in the mine is naturally to be able to treat and eliminate them.

Explanation of the systems concept should be followed by study of the actual mechanics of accidents. This too should persuade managerial staff that accidents have complex causes and are not inevitable. The mechanics will be studied using a variety of mutually complementary procedures.

1. *Analysis of occupational accidents.* Various methods can be used to reveal the greatest possible number of factors causing accidents. For example, there is the "genealogical tree" (the method conceived by Professor Faverge), which consists in going back in time in order to discover the relationships between all the immediate or more remote

circumstances which gave rise to the accident; the analyst must pursue his investigations as long as he keeps finding a previous cause.[6]

One might also mention, although it is harder to apply, the method developed by the French National Research and Safety Institute for the Prevention of Occupational Accidents and Diseases (INRS), which consists of noting any variations in the man-machine system at the time of the accident compared with previous situations. A precise analysis can then be made with the help of a diagram.

This must be followed up by an objective interpretation of the results of the analysis taking into account all the factors involved in the accident. The value of these methods can be demonstrated by comparing the interpretation of an accident which results from applying them and that offered by an untrained agent.

2. *Statistical analysis.* Trainees will learn how to classify occupational accidents and list them according to seriousness, location, situation and type of operation; these classifications and lists will provide a useful basis for initial efforts at detection and will help to channel research in the right direction. Trainees could also study the relationship between the variables of the system and accidents by examining first of all the effect of a single variable, and then the effects of two or more. Factor analysis methods are also useful in this area.

3. *Experimental analysis.* It is sometimes possible to conduct on-site experiments by changing one aspect of working conditions and seeking to determine whether it affects safety. Experiments can also be carried out in laboratories by simulating simple tasks.

Once the mechanics of occupational accidents are understood, training should be given in preventive work. By learning to diagnose occupational hazards the trainees will be able to choose the type of preventive action best suited to solving a particular problem bearing in mind the mine's possibilities.

Preventive measures will fall mainly into the following categories:

1. *Safety rules* (instructions). Care must be taken to ensure that these are coherent and not contradictory; that the work programmes are such that they can be observed; that the number of rules is not so great as to risk overburdening the operator's memory. The instructions must be simple and formulated in everyday language. Use should be made of illustrations where possible and special arrangements should be made for illiterate workers and migrant workers who only speak a foreign language.

2. *Posters, slides and films.* These are a very useful and even essential means of propaganda during safety campaigns. However, one must be wary of seeing them as a panacea and bear in mind their limitations.

3. *Information.* This is essential and must be provided at the moment of hiring and supplemented during training.

4. *Personnel management.* Any motor system, intellectual, character or other defects must be brought to light at the time candidates are recruited. Policy governing the assignment of workers to particular tasks should be made more selective and systematic, and as far as possible piece-work should be eliminated.

5. *Personnel training.* The value of standardising methods of communication and of providing proper training for secondary operations should be demonstrated. Staff should also be taught to anticipate dangerous situations and perceive the risks involved (here films are appropriate) as well as to understand the special problems of working in groups.

6. *Ergonomics.* The principles of ergonomics should be applied to safety, either in putting right existing installations or in the design of new equipment, and manufacturers should be required to respect these principles; as a result, it will be possible to reduce the number and range of regulations to be studied in the training programme.

7. *Organisation of work.* Better work organisation should lead to an improvement in communications and co-operation between departments, proper circulation of information on safety and the elimination, as far as possible, of hazardous situations.

Following this the trainees could usefully be shown how to evaluate the results of these various preventive activities. Here one could use direct evaluation (comparing the frequency rates of accidents, percentages of working time devoted to prevention), which must be continuous and serve for example to indicate whether the effectiveness of safety campaigns is diminishing with time. Another possibility is to study the evolution of the economic cost of accidents: contribution rates for employment accident insurance, cost of material damage and inquiries, rehabilitation costs, and so on.

Finally, the training of executives and engineers will conclude with a study of the economic burden resulting from occupational accidents and the legal issues they involve.

From the practical point of view, any future manager of an undertaking ought to spend some time in the mine's safety service.

Programmes for foremen and trade union representatives

For these two categories—which we lump together because they come from the same milieu and are of a practical bent—the training will have two main objectives. First, as for managerial staff, they will be shown that occupational accidents in almost every case have not one single cause but many. They should be taught a simple and concrete method of analysing these causes. Above all, they should be made fully aware of the fact that accidents are not inevitable. Secondly, training should encourage them to improve communication with rank-and-file workers.

As regards the first point, the foremen will be trained to practise the genealogical tree method whose use we have already advocated for managerial staff and on the basis of which possible types of action can be identified.

As regards the second point, it must be brought home to the foremen, who spend all their time on the worksites, that they are the people best placed to influence the behaviour of the workers under them. They can change the workers' behaviour if they make a habit of talking to them regularly about situations involving risks, listening to them when they come up with ideas about improving conditions of work, and reminding them of the basic safety principles to be observed in their work.

The trade union representatives, for their part, should be introduced to the legal aspects of safety problems so as to enable them better to defend the interests of their constituents.

Programmes for the rank and file

These programmes will include activities designed to heighten their awareness of safety problems through audio-visual means (posters, slides, films); information (leaflets, diagrams); and continuous efforts by the foremen to get the message across through discussions with the workers.

As regards the first of these activities, posters will have to meet certain criteria, make an impression and sometimes even shock. The important role of safety colour codings must also be kept in mind. A poster should produce its effect by surprise and repetition, capture attention in a few seconds and imprint itself on the memory. It should be displayed where it will be seen by the greatest number of people and there should be numerous notice boards.

It is the poster, therefore, that should be exploited to the fullest possible extent, but slides and films will make a useful back-up. Several types of films can be used: very short films, designed to inform the whole workforce rapidly; discussion films, covering a single theme from one or more angles, designed to lead to subsequent group discussion that will help to throw up possible solutions; and educational films, designed as vehicles for certain training programmes.

As regards information, too much stress cannot be laid on providing the workers, particularly machine operators, with tellingly illustrated leaflets warning them of the risks associated with their work and of what should be done and not done. Where necessary the foremen can explain these leaflets to the workers, adding their own comments, and thus satisfy themselves that they are perfectly understood.

In addition, we suggest that each worker in the mine or quarry should be issued with a personal safety card which he must carry on him and on which the risks he runs in his work are clearly stated. It should also list the principal steps he can take to avoid accidents and health hazards.

A third and final point: meetings with the supervisors on the worksite—if possible every day—should be considered absolutely essential. The foreman will comment upon any accidents, the day after if possible. He will pass on to the workers the results of his analysis and the recommendations he would like them to observe. He will take careful note of their responses and will not hesitate to discuss safety matters with them. If it is to make an effective contribution to the improvement of safety, the daily discussion should be kept brief and to the point.

Practical applications

A look at what is going on in the world in the field of workers' safety training will show that in several countries some of the methods we have briefly discussed above are being applied in various forms and with a few modifications.

In the coal mines in the USSR, for example, new recruits and workers moving from one job to another are obliged to follow preparatory training courses. In this connection every coalfield has a centre equipped with all manner of training resources. These centres organise full-time courses lasting ten days and designed primarily to teach the trainees the skills and habits which will enable them to carry out their work in the best possible safety conditions.[7]

Since 1972 the Mines Safety and Health Commission of the Commission of the European Communities has organised a series of safety campaigns in the various coalfields of the Community. Each campaign consists of two phases. The first, aimed above all at the directors and managerial staff, involves the preparation of material relating to the chosen theme. The second is aimed at arousing safety consciousness in the workers with the aid of posters, films, gramophone records and competitions. Each year special days are set aside for briefing trade union representatives. These meetings are held in one of the coalfields and provide an opportunity, on the one hand, to inform the workers' representatives about the activities of the Mines Safety and Health Commission and, on the other, to acquaint this Commission with fresh problems which need to be studied.

* * *

For both social and economic reasons occupational safety in mines and quarries must be considered at least as important as the improvement of productivity. It calls for an effort on the part of each individual and close co-operation between the employer and the entire workforce if a satisfactory quality of working life is to be obtained. Training occupies a major place in this scheme of things and, as we hope this brief survey has

demonstrated, it is an activity in which every occupational category must be involved: each is either dispensing or receiving it—and alternating between one role and the other.

Notes

[1] This article is based on ILO research on occupational safety in haulage and transport in mines and quarries.

[2] *Employment and Productivity Gazette* (London, Department of Employment and Productivity), Apr. 1980.

[3] C. Nussey: "Studies of accidents leading to minor injuries in the UK coal mining industry", in *Journal of Occupational Accidents* (Amsterdam), 1980, No. 2.

[4] See Commission of the European Communities: *Health in mines.* Synthesis report on research in the third programme 1971-1976, Industrial Health and Safety Series (Luxembourg, 1978).

[5] J. Leplat and X. Cuny: *Les accidents du travail* (Paris, Presses universitaires de France, 1979).

[6] This method was the subject of a very interesting study by Méric, Monteau and Székely: *Techniques de gestion de la sécurité* (Paris, INRS, 1976; report 243/RE), which gives an example of detailed analysis of an accident.

[7] See A. Semenov: "Industrial safety training for Soviet workers", in *International Labour Review*, July-Aug. 1978.