SAFE PRACTICES BY AUDIO-VISUAL TEACHING METHODS IN THE CHEMICAL INDUSTRIES

Second Item on the Agenda

Report Prepared by the International Labour Office
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Introduction

At its Fifth Session (Geneva, February, 1958) the Chemical Industries Committee invited the Governing Body of the International Labour Office to place upon the agenda of the Sixth Session of the Committee the item 'Safe practices by audio-visual teaching methods in the Chemical Industries'. At its 147th Session (Geneva, November, 1960) the Governing Body acceded to the Committee's request and the Office has prepared the present report to serve as a basis for the discussion of this item.

The report arises out of part of the proceedings of the Fifth Session of the Chemical Industries Committee held in Geneva, 10-21 February, 1958. The fields of occupational medicine, hygiene and safety have no clearly definable boundaries as between each other. The differences in the academic and professional training of their exponents impose certain limits on the scope and work of individual specialists but these limits in themselves, when clearly understood, are such as to show the necessity for co-operation between industrial medical officers, industrial hygienists and safety officers.

Though this report presents a summary of visual aids for a specific purpose, the key words are "safe practices". The prevention of occupational diseases and poisoning, the subject of Resolution No. 33 adopted by the Committee, is obviously impossible without constant close attention to, and training in, safe practices. It is, of course, quite insufficient, as is indicated in Resolution No. 33 that the health, safety and general well-being of the industrial worker should be regarded as being the particular province of specialists such as those quoted. Though primarily the responsibility of employers, they demand special knowledge and active collaboration among all ranks. They also require close consideration at every stage of manufacture, from the first stages of a project to the final plant on full production.

In many organisations, the effort expended on these special risks has achieved a state in which the records of occupational diseases and poisonings in the chemical industries is as good as those of other industries. Nevertheless, it is recognised that there are serious dangers which can only be avoided by constant vigilance and unremitting effort.

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These direct dangers to life and health are not the only hazards which could arise in the industry from technical causes, if they were not controlled by the inculcation of safe practices at all levels of staff and at all stages of research and manufacture. This report, therefore, attempts to proceed from the special health problems raised in the report on the subject discussed at the Fifth Session to some aspects of the training and organisation which are necessary to reach good standards of safe practices generally. It will be seen that the studies from which this report results have revealed a marked similarity of approach and principles. These are now extended to a wider field and their practical application is illustrated by examples of current practice.

That these matters should receive close and sympathetic consideration at the highest levels was evidenced by Lord McCorquodale, the Employers' delegate of the United Kingdom at the 45th Session of the International Labour Conference held in June 1961 when he said:

"There are few nobler or more important tasks for an employers' organisation that the protection of its workpeople against the hazards of industrial life whether in fields such as electronic and nuclear development or in the handling of quite simple mechanical aids. Employers' organisations are in the best position to collect and to collate information as to the causes of accidents, and this method of collecting and sifting data has resulted in some remarkable achievements. The causes of many accidents have been entirely removed and the causes of others have been greatly reduced. The information so compiled has assisted the Government in the formulation of practical basic standards of protection, but these basic standards we believe do not go far enough, and we think that a positive approach by employers and workpeople acting together towards the elimination of hazards is an essential complement to this work.

In an industrialised society where techniques and processes are constantly changing, men and women have to be trained daily in new techniques and new skills. Training takestime and training schemes must therefore be developed in the light of future trends. An employers' organisation through its members is in a strong position to assess these trends and to adjust our training accordingly".


In its broadest interpretation, the term "visual aids" can be applied to all visible teaching media, and in this sense it may be said that the use of visual aids for teaching and training purposes is as old as teaching and training in themselves. In fact, instructors have always used drawings and sketches to assist them in transmitting their knowledge. However, in so far as the specific present-day use of the term is concerned, and also its meaning in relation to the present paper, the words "visual aids" include in the main all kinds of group teaching aids dependent essentially on the use of sight. Visual aids will therefore include, on the one hand, models, exhibits, posters, charts, blackboard drawings, and so forth, designed to strike the trainee's eye on a semi-permanent basis either during the training programme or otherwise and, on the other hand, moving films (sound and silent), film strips, slides, etc., which are used by the teacher and instructor to transmit ideas and experience through the assistance of the eye. Even within these definitions, it is extremely difficult to state categorically what should or should not be considered as visual aids. It is possible, for instance, to include within this definition certain instructional books in which illustrations, diagrams or charts have a value as great as, or greater than, the written text. The principal distinction between the use of visual aids for training and the use of other forms of instructional techniques is therefore a matter of emphasis. Visual instruction emphasises the value of concrete or non-verbal experience in the learning process; other forms of instruction stress verbal or symbolic experience.

In countries where industries are already highly developed or where rapid progress is being made, it is regarded as essential to aim at safe practices by safety training which forms an integral part of training for work and the induction of the new worker. This is particularly the case in the chemical and analogous industries. In these industries there has been a remarkable expansion in many directions — in size of organisation, new and improved products, size and complexity of plants, most of them highly automatic. The techniques of research, design, construction and installation have improved at a great rate, as have the techniques of managing and supervising. The workers also are well informed about the nature and requirements of their jobs and feel that they have an active and personal contribution to make to their complex industry.

The present report is primarily concerned with a small but essential part of this last aspect, which itself cannot be fully appreciated without some consideration of the history and present technical background of the industry. Part of the contents will, therefore, seem obvious to the experienced, but the aim has been to make practical knowledge as widely available as possible.
In collating the report, careful studies have been made of information which has been supplied by or from many countries, either through government agencies or through individual firms, employers' associations, trade unions or non-profit safety organisations. The International Labour Office wishes to express its appreciation for the invaluable help it has received from these sources. The Office has also been greatly helped by their manufacturers in the matter of classifying and assessing a fair sample of the many different aids which are available commercially. In addition, members of the staff of I.L.O., in the course of visits, have been able to make inquiries of current practice and developments in France, the Federal Republic of Germany, Italy and the United Kingdom.

It seems clear that the principles and practice of inculcating safe methods of work are much the same in all forms of large-scale industrial chemical organisations, as well as in many concerns which by comparison are small. This last fact is important.

Though the general tendency is to create and reorganise chemical industry on a large scale, there are many examples of small works concentrating on a limited number of products. They continue in their own field to compete successfully and safely, and can provide studies and experience in developing countries and in countries where industrial planning and organisation are necessarily still on a limited scale.

Philosophies of industrial production vary greatly, but there is at least common ground in the well-proved fact that all ranks in industry can be led and encouraged to take a proper pride in safe working and, in consequence, efficient working, as well as preventing the human suffering caused by accidents. In the chemical industry organised efforts to eliminate accidents are obviously an economic proposition. The essential training for much of the special work in the industry costs money and time but, even apart from considerations of humane management, the loss, whole or partial, of skilled workers with possible serious damage to costly plant, will cause excessive falls of production. Experience shows that the cost of safety training and organisation are well repaid by the avoidance of these tragedies and disasters. The subject matter of this report to the Chemical Industries Committee is one with which some, in the advanced sectors, will be familiar in theory or practice, or both. At the same time, there are varying degrees of development and knowledge in countries with long histories of chemical industry as far as training and training for safe practices - is concerned. The text has been written not only with the above fact in mind but from the point of view of providing an expression of current experience.
which may be useful to developing countries. A logical hope is that, with the outline provided as a basis in this report, central national and international organisations could, if required, provide detailed information and guidance suited to individual needs.

In this connection, it should be mentioned that as far back as 1929 the I.L.O. recommended the adoption of measures for the promotion of industrial safety, insisting on the need of awakening and maintaining the interest of the workers in the prevention of accidents, ensuring their cooperation by means of lectures, publications, films and such other means as may be found most appropriate. The establishment of permanent safety exhibitions, the improvement of the education of the workers in the prevention of accidents as well as their cooperation in this work, are some of the safety measures suggested. In addition, governments were advised to arrange for the preparation of monographs on accident causation and prevention embodying the experience obtained as to the best measures for preventing accidents in the industry or process, for the information of employers, works officials and workers in the industry and of employers' and workers' organisations. It was also recommended that instruction in the prevention of industrial accidents should be given in vocational schools of all grades. It was further suggested that cooperation in accident prevention could be achieved by awarding prizes to workmen and others who, by their intentions or ideas, contribute substantially to avoid accidents, as well as by means of propaganda among employers and the public, by giving advice on safety measures and by contributing to the setting up of safety museums and institutions for instruction in accident prevention.

In 1947, the International Labour Conference recommended that arrangements for collaboration between employers and workers should be encouraged to improve conditions affecting the health and safety of the workers and steps be taken to ensure that employers and workers are given advice and instruction in questions of industrial safety by such measures as lectures, radio talks, posters, pamphlets and films, health and safety exhibitions and instruction in industrial hygiene and safety in technical schools.

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2 Labour Inspection Recommendation (No. 81) 1947, in The International Labour Code, op. cit., Articles 926 and 929. See Appendix II.
At its Fifth Session, the Chemical Industries Committee decided that the basic training of chemists, engineers and technicians should include instruction in safety and health measures, and, further, that the training of chemical workers should include instruction in the hazards to which they may be exposed. Such training can be ensured by:

(a) instruction during the course of preliminary training;
(b) regular training programmes;
(c) pamphlets, posters, lectures and data sheets;
(d) regular instruction by competent medical or technical persons; and
(e) warning labels affixed to containers of dangerous substances.

The report is presented under six main heads. Chapter I consists of a brief survey of the chemical industries development in special relation to safe practices from the point of view of the higher managements of existing and developing manufacturing organisations. In Chapter II, a description is given of some of the main visual aids, with some comments on their use and abuse. Chapter III deals with problems of organisation for safe practices, including those requiring to secure the proper use of audio-visual teaching methods. In Chapter IV are given, drawn from current programmes in use in the chemical industries, practical measures to inculcate safe practices. In all such practical measures, audio-visual aids applied to specific purposes and subjects will not only speed up the processes of teaching and training, but should bring about the more lasting impression of things seen. The part of central authorities and associations in industrial safety is described in Chapter V. Finally, Chapter VI sums up the information provided and a list of points is added in case the Committee should find it useful in conducting its discussions.

Generally speaking, Chapter I is addressed to managements as a suggestion of a foundation policy for their safety organisations. The rest of the report is intended to appeal, under its different headings, to the research staffs, designers, technicians, supervisors and safety organisations to whom are remitted, in the course of their work, the establishment of, and adherence to, safe practices.

A much abbreviated reference list on the specific subject of visual aids in teaching and training is appended to the report.

CHAPTER I

THE BACKGROUND FOR MANAGEMENT

There is available a vast amount of printed matter dealing with audio-visual aids, but anyone wishing to use it may, in the first place, find it rather difficult to track down and collect. It will be found, also, that some of it is repetitive, or only relates to very limited circumstances, or aspects of the problem. The practice of devising and using these aids resolves itself into intelligent and informed adaptation and application to a given subject and a given audience.

The question, therefore, naturally arises: what is there that is special in using these aids in training for safety in industry, and in particular in the chemical industries? The answer requires a restatement of some obvious facts about the chemical industry, and also about the organisation of industrial safety in general.

New Techniques and the Accident Problem

In the first place, the techniques of design and production have advanced enormously in the major chemical manufacturing countries during the past 30 years. One result is that accidents to human beings through gassing, explosions, fires and similar technical causes have in a very substantial number of plants been almost eliminated. Precautions against these sources of danger are the responsibility of the qualified managers and technicians. Personnel of this calibre are already trained to a high degree of professional competence. Safety is, for obvious reasons in industries with inherent hazards which must be controlled, an important aspect of design, construction and operation. Instruction is frequently provided in technical safety manuals, engineering safety codes and regulations, and detailed operating instructions. A few examples of these are given in this report. It will, however, be appreciated that audio-visual aids as generally understood are employed only to a limited and specialised extent for training for high grade technical control of production. In this connection, however, it should be noted that scale models are now commonly employed as practical adjuncts to drawings. It is admitted by many engineers that such models are of special value in checking overhead and side clearances in plants, the siting of gangways,

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1 To assist those concerned, a selected bibliography, which is intended only as a guide, is appended to this report.
stairways, gantries, cranes, valves, etc., good routes for removing plant which has to be transported en bloc for maintenance, fire-fighting hydrants, and so forth. There are many examples where errors in these matters have been incorporated into plants which have been constructed solely from drawings. Models such as these are a most practical form of visual aid for senior managers and designers and later for the general instruction of all workers in the plant.

Developing Countries

A second and different aspect of safety as part of design and production technique probably arises in countries where chemical industries are of recent development, or are at the moment included in the early stage of planning in a country's economy. In these conditions, it seems reasonable to suggest that much trouble and disaster might be avoided, and much time saved, not only by technical assistance, but by systematic visits to plants in the countries where these industries have been more highly developed. Several countries in this last category provide a valuable service in selling complete plants of many kinds together with what is called "know-how". For the newer countries this is something which may prove valuable. These complete plants are also bought for various reasons by countries which are already highly developed, and it is the general experience that these plants have their "teething" troubles - some of them important - before they finally reach full production. This is a natural phenomenon, and one to be expected in the complex plants of today. It is essential, therefore, that the technical staffs who will eventually operate such plants should have personal experience of similar plants. It may be that this can only be gained by visits to other countries, for the best audio-visual aid for this vital matter is to see the job done, and to have had it explained. To stress the obvious, the higher techniques of the chemical industries cannot be learned from textbook and lectures (though they cannot be learned without them), neither can these techniques be well appreciated from experience of only one type of plant.

Exchanges of Experience

Manufacturers or technical agents who sell the complete plants, such as those mentioned above, will, if they are responsible firms, fully conscious of their obligations, regard it as their duty to provide technical instruction as part of the deal according to local circumstances, and always assuming that their staffs who will operate the plants have received the training and practical experience indicated in the last paragraph. Where developing countries are planning to install modern chemical industries for the first time, the best methods of obtaining the necessary information, training and experience are
probably through fellowships under the technical assistance programmes or by arrangements with chemical industries in developed countries, or with the manufacturers of the plant. It may be noted that the obtaining and exchange of experience is by no means confined to developing countries; there is a constant interchange of international visits between the technical staffs of the advanced chemical industries. Apart from strictly technical knowledge, much advantage has been gained by the exchange of experience relating to training for highly specialised work as well as standards in safe practices.

The Training of Specialised Workers

The third special aspect of safety training in the chemical industries is created by the "automatic" operation of the majority of processes. Automation is no new thing in chemical manufacture and as far as the production is concerned, whether final or intermediate, the number of workers involved is comparatively small. The training of such workers is highly specialised within a limited field which concerns their own particular task. This task may seem to the uninitiated to be one of simply watching dials, gauges, temperature recorders, coloured lights and the like, but it implies a considerable sense of responsibility, the ability to think quickly, and an inherent freedom from perceptual fatigue. These workers have usually been promoted from more general operations, and it is probably in their earlier stages that audio-visual instruction combined with general training enables the best workers to reveal their competence for more specialised work, and also their appreciation of the hazards in a chemical plant. In their special process work, the best audio-visual aid is a good supervisor who has himself been systematically trained.

Consideration of the functions of process workers in modern organisations and automated industries seems to imply that any audio-visual aids which may be used to inculcate safe practices must be specifically designed for special tasks. They could include model or dummy instrument and control boards and desks, with the appropriate alarms, coloured and flashing lights, signals, instrument dials, telephones, etc. Devices for testing personnel reaction time under different conditions are also useful, together with methods of training designed to improve their reaction time.

The Training of Foremen

A different situation exists in the training of foremen in the chemical industries. The work is specialised, and so is the training. Whole-time courses of several months for foremen are by no means uncommon. When analysed, such courses are found to be highly intensive systems of education in chemistry,
mathematics, management (including safety organisations), the law relating to the industry and similar matters which were (and sometimes still are) outside the conception of the foreman who had grown up from boyhood in a much less complex industry. In such courses, covering as they do a wide field, it seems that audio-visual aids could be fully employed. Reference is made later in this chapter to audience receptivity.

**Repair and Maintenance**

A less specialised approach to principles and practice is concerned with the alternation, maintenance, repair and demolition of chemical plants. In this type of work, which is essential and cannot be automated, there are many dangers which could mostly be avoided by well considered operating procedures and proper supervision, training and instruction. A note in a later chapter of this report deals with this aspect.

**General Factory Hazards**

Electrical hazards, boiler plants, power houses, transport and traffic hazards (including safety on the roads, of which there are frequently miles within chemical works) are not, in most instances, special to the industry except where hazardous substances are concerned. Where these risks exist, as in the case of packing and transporting dangerous substances, special instructions and training must be provided. Examples are given in a later chapter.

**Containers of Hazardous Substances**

These substances and their containers are generally well controlled by design and training, but there are methods, including audio-visual aids, which should be used as constant reminders to operators of the risks. Reference is made to them later. At the same time, those hazards which are not special to the industry have been, and still are, the sources of accidents which have involved death and serious injury. They must be included in the subjects requiring continual reminders, if a good standard of safety is to be achieved and maintained. The visual aids of a general character, as used in most industrial safety programmes, are of considerable value in dealing with these aspects. The best advise is to be obtained from the central authorities and organisations in the countries concerned, as indicated in Chapter V.

**The Common Causes of Accidents**

So far this chapter has dealt indirectly with some technical accident causes which are obvious enough if appropriate measures
are taken to command the attention of management, supervisors and workers. The fact remains that about two-thirds of all industrial accidents come under the headings of:

- Falls of persons;
- Falling objects;
- Handling materials.

Even in highly organised factories with the most modern equipment, well considered layout, and comprehensive safety organisations, where the total of accidents represents a low frequency rate, these proportions remain approximately the same. This is also the case in factories, including chemical factories, where a substantial reduction in all types of accidents has been achieved.

**Two Main Considerations**

Before considering the encouragement of safety precautions which will reduce these types of accidents, it is necessary to determine with complete frankness:

(a) what are the real causes of accidents and especially of the high proportion of accidents which come under the apparently simple headings indicated above?

(b) what are the reactions of industrial personnel - all ranks - to the safety precautions which are necessary to reduce the incidence of these types of accidents?

At this stage, the answer to the question put at the beginning of the chapter must be given: What is there that is special in using audio-visual aids in training for safety in industry, and particularly in the chemical industries?

As far as the chemical industries are concerned, the situation now is, or should be, that dangers from technical causes or from escaping gas fumes, dust, dirt and general untidiness, arise only infrequently. Such matters are, as has already been stated, well controlled by co-operation between technicians, managers, supervisors and workers. These principles are by no means special to the chemical industries; other industries use them with demonstrable success. What is special is that the chemical industries in some countries frequently achieve a lower accident rate than most heavy industries. Their methods are, therefore, worth studying.

**The Reactions of Personnel to Safety Training**

The reactions of the personnel in the industry to safety questions and to safety instruction have been matters of interest and close study in the past years.
Technical and Supervisory Staff. As far as the technically qualified staff and the supervisors are concerned, their attitude is conditioned by the example of their superiors. If the chiefs of an organisation make it clear that they expect high standards of safety and that they consider the matter of sufficient importance to give some of their own valuable time to show their personal interest, there is generally a noticeable reaction. In an increasing number of instances the safety record of the employees in their charge is taken into account in the promotion of managers and supervisors. In many cases, a safety tradition of some years brings about a general keenness for high safety standards which is integrated in the general professional approach to management and supervision.

Approaching the Workers. Where the workers are generally concerned, that is except when they have been strictly trained for a special task which is hazardous unless it is correctly performed, the case is naturally different. In ordinary life - much of the time spent in work is part of ordinary life - it is a common tendency to be careless of one's own safety, at least from time to time. Unless vigorous and persistent methods of reminder are used, most of the personnel in a works will feel consciously or subconsciously that they are not personally concerned with these types of accidents which cause most casualties - falls of persons and objects and handling materials. They feel that these aspects of safety are negative. "Such accidents do not happen to me" is what they usually think.

This is the most arduous aspect of the task of establishing a high standard of safety precautions. It is not difficult to arouse interest in training for special work, where the pay and prestige are probably both higher. In these cases, audience receptivity is high. To arouse and maintain interest in the simple fact that falls on the level cause the highest proportion of accidents (to quote one example) is a challenge requiring unending energy and ingenuity. Here, audience receptivity is at its lowest. However, substantial reductions in the rates of such accidents have been gradually achieved over long periods of time (see Table I).

The Coming Expansion in the Chemical Industries

In producing this report the Office, in addition to drawing on current experience in highly developed countries, has also very much in mind the great expansion in chemical industries which in the coming years will take place in many of the developing countries.

Modern chemical industry is not alone in having reached its present high state of development by trial and error, at least in
part. There is no question of "transposing alien systems of proved effectiveness" but of dispassionate study and intelligent application to national and local conditions.

Here, in the achievement of safe practices, is a small but vital part of the whole plan of production and management, the methods of training, guidance, persuasion and reminder have been slowly built up over many years. While there must be a focusing point - a safety organisation - the influence and importance of the matter is such as to demand the instruction and co-operation of all members of all ranks in a works. An honest attempt to reach this state provides, in addition to its practical objectives of avoiding accidental death, injury, waste and damage, a common platform and a community of interest from which all in a works gain advantage.
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**Table 1 - Projection of Accidents in a Large U.K. Chemical Manufacturing Plant**

- Accidents in the number of accidents per 1,000 employees estimated
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Some Basic Principles for Managements in Planning for Training in Safe Practices

As already stated, there is a vast amount of printed matter about visual aids. The manufacture and selling of these aids has become big business. There have also grown up a number of audio-visual associations, some with a strong commercial flavour. Others are associated with specialised government agencies (e.g., health), others maintained for developing countries from government funds, charitable trusts, and so on. There is a danger of confusion arising from the mass of information, opinion and materials available, and it seems proper to suggest a few basic principles.

Principles of Audio-visual Aids

All these aids are really based on chalk-board models and magic lantern techniques, reinforced in the more complex forms by electro-mechanics and electronics. Their special function is to grip the attention and the interest of the audience, and to provide the vivid visual impression which remains in a more or less marked degree in the mind of the recipient. Considered internationally, they can, if studied and modified in advance to suit local circumstances, be of almost universal value. But it is most important to realise that all these devices are only a part of well considered schemes of training, instruction and reminder. In the petroleum industry, which probably has the most experience in using visual aids in training, it has been said that "the use of visual aids by themselves will not accomplish magic, neither will they do a training job by themselves".

A thorough practical knowledge of the subject, as well as skill (though not necessarily whole-time professional teaching skill) are essential.

Fundamentals in Teaching Safe Practices

The important principles specially applying to teaching safe practices are:

1. Safe practices are the concern of all ranks in industry.

2. A good safety record stems from an explicitly expressed policy by top management.

3. Pursuance of that policy by works managements.
4. Practical application of policy by research staffs, designers and technicians.

5. Personal example and leadership in safe practices by all managers, supervisors and foremen.

6. Active participation and co-operation by the workers.

From the above it is clear that fitful and haphazard efforts to secure safe practices cannot succeed. Safety is not to be had, for example, merely by the exhibition of posters, striking accident record boards, and the occasional showing of a film. A long term plan is essential, complete in itself, but revealing its vigour by its built-in capacity to develop.

In planning a fully considered and integrated scheme of training, it appears from experience that there are three important matters at least which have to be well organised and watched if the best use is to be made of training and instruction, including the use of audio-visual aids.

The Choice of a Trainer

Obviously the choice of a trainer is of first importance. Yet, human nature being what it is, there have been found teachers and trainers who do not inspire much confidence, nor arouse interest. The original error here is often that which has been made frequently in relation to such jobs as safety organisations, welfare and personnel departments and similar functions. These have, apparently, not been considered as being immediately allied to production and, as such, have been allocated to persons who happen to be available for one reason or another and not for the reason, which is the only valid one, that they have characters and experience which fit them for the job. A really good and well trained safety officer is, in most instances, the best person to be in charge of the task of advising on training in safe practices. He will understand, from the start, that safety in works cannot be achieved by regulations and directions alone, but for the most part by patient, persistent persuasion. He is the focussing point in the plan to get all in the works to realise that everyone has a large share of personal responsibility. His own training will include something of the art of teaching and of the use of teaching aids. His approach to his job will be such that he will be able and willing to pass much of this knowledge on to his colleagues, supervisors and foremen who, in turn, can influence and instruct those in their immediate charge. It is therefore essential that facilities for training safety officers, industrial teachers and trainers should be available either through governments, international organisations, employers' associations, trade unions and voluntary welfare
and safety societies and also large industries. The object is to select and train men who can command confidence and respect, talk on reasonably level terms with all ranks - and be properly paid.

**Importance of Advance Study**

The trained safety officer who plans a special campaign such as a safety week, or a special campaign against fire, or the safe use of hand tools, makes his preparations well in advance. Every training course, or session, or lecture or simple talk also needs careful preparation, including practice where visual aids are used. Much of the value of a session of a campaign is lost through faulty or hasty advance study and rehearsal. The programme must allow time for this, especially remembering that many apparently simple and obvious aspects of safety have to be presented with much skill and vigour to grip attention.

**The Use of Notes**

Where safety training is concerned with small classes or groups, as is often the case, every opportunity should be taken, with literate people, to provide the class or group with copies of the notes used by the teacher or lecturer. This is common practice in dealing with "case studies" with the aid of films and film strips, and usually succeeds in promoting group discussions, a most valuable addition to the lesson by ear and eye. In considering the summarised advice which it should receive, the management would be wise to check that time has been allowed for verbal interchange between the trainer and his class and also for group discussion. The speed with which training is conducted is no criterion of its effectiveness in the long run.

**The Key Question for Management**

If principles of the nature implied in this chapter, which is addressed primarily to managements, are agreed, according to local conditions, a short progress report can be requested at regular intervals from the safety organisation or its equivalent. Statistics and reports of accidents are not enough, even for the busiest directorate. The questions, which can be answered in a few hundred words are:

What is being done? and

Is the undertaking, in the widest sense, getting value for the money and energy expended?
The Development of Safety Training - First Stages: For Management Action

In his own field, the trained and experienced management and technical specialist in modern highly-organised industries finds his own task, within its imposed limits, relatively easy. He inherits the work and traditions of many years. Much of the skill of higher managements lies in making past experience readily available. Many of the problems which bedevilled them in their early years in industry have been solved to the extent that many members of their staffs are unaware that they ever existed or that these same problems remain, in more or less acute degree, in countries and industries less fortunate.

The Importance of Local Characteristics

Developing countries and industries are, naturally, spurred by the idea of making rapid progress. It is true that there is valuable current experience available on request, which would be of great help to them. Other and more urgent factors (economic and technical aid are examples) being equal, the time taken to achieve a good level of efficient production should be much less than was the case in the older countries with the hard experience, including many mistakes, of a hundred years. But though progress may be quicker, it must still be gradual. The attainment of a reasonable standard of safe practices in industry is no exception. They are achieved, fundamentally, by good technical control, co-operation and common sense. These characteristics do not create themselves spontaneously. Good technical control implies arduous training. The essence of co-operation is experience and appreciation of leadership and management. Common sense is only too often something of which the use in work has to be taught. These things take time, and can only proceed step by step. Reliable experience can indicate the rough structure of the steps but, as an entity, the steps will have to be built up to suit local characteristics.

Example, Not Exhortation

The essential first stages of attaining a good standard of safe and efficient production are not, as was once imagined, reached by exhorting the workers. The important thing is example. The example set by management in providing a safe place to work, and a focussing point for safety organisation, practical everyday example by technicians, junior managers and supervisors, example provided by training and reminders using audio-visual aids (in their widest sense) emphasising the advantages (which should be obvious, but frequently are not) of using correct and safe methods. These cost money and time, but a successful plan is a good investment, both as regards efficiency and human relations.
Elementary Aspects of Safety

Elementary dangers which can be avoided in factory life can be demonstrated from experience and from simple analyses of accident causes. It can also be demonstrated with certainty that without a focussing point in some form of safety organisation these elementary dangers will continue to cause casualties and damage. Some simple lines of attack, chosen practically at random, are given below. It may be remarked that simple as they appear, there are many places of work even in the industrially advanced countries where little or no attention is paid to them. The accident rate is correspondingly — and unnecessarily — high.

Cleanliness and tidiness in works. (A chemical works can be as clean as a food factory.)
Proper places for waste and scrap.
Keep gangways clear.
Use protective devices provided.
Never run in the works except in dire emergency.
Insist on correct training in the use of tools, machines, apparatus, transport.
Traffic discipline.
Proper stacking of materials and containers.
Get first-aid.
Observe works regulations.
Never interfere with specialist jobs requiring a qualified worker — especially electricity.
If you do not know — ask.
Emergencies — fire, gas escapes, explosion, etc. — know what to do.
Discuss safety matters with your foreman.

Importance of Practical Training

These and similar matters are the ones which must inspire the basis of a carefully considered plan to secure the increasing co-operation of the workers. These are aspects of industrial life in which common sense should prevail, but in which it certainly does not without direction, guidance, persuasion, example and constant reminder. It is quite false for persons with educational or other advantages but with little or no experience of manufacturing industry to imagine that what is obvious to them from a study of the "literature" on industrial management must be equally obvious to the workers. Pursuing
this line of thought and experience, both past and current, many managers and supervisors, unless they are properly directed and trained, will also continue to hold to these wrong views - that people should use their ordinary sense of self-preservation, or that casualties in manufacturing industry are inevitable.

**Function of the Safety Officer**

Managements will realise that these and similar subjects are those which provide a good safety officer - whole or part-time - with his first opportunities of proving his value as a focussing point in a non-executive capacity. This is another important point for emphasis. The most successful safety organisations are those which have reached the stage where it is accepted as policy that safety is actually achieved directly by managers, technicians, and supervisors with the active cooperation of the workers in their charge. The safety officer is the trusted adviser of all, as well as the leading trainer. His own personality must be subordinate to the principle that he does not interfere with the line of command. A common error of some organisations is that there is confusion in the line of command. In so-called advanced countries, intelligent workers can still be met who have never seen their boss or even do not know who he is. In chemical industries, mention of the "Firm" or the "Works" almost invariably brings to the worker's mind his foreman. There is the line of command, and any form of organisation or training which fails to recognise it is certain to lose much of its possible effectiveness. To avoid any misunderstanding it should be stated that this principle is accepted by all in many industrial firms and works where joint co-operation, works' committees and similar evidences of democracy flourish.

One of the essential features of organisation and training - including those for safety practices - is, therefore, that it should be consciously aimed at making the foreman's task easier and more efficient. He is the key man.

**Management Support**

Neither the foremen nor the safety officer can do much about the simple causes of accidents without strong management support from the top. It is of no use, for example, to try to keep the place of work clean and tidy if there is no designated depository in which to put scrap. Exhortations to keep gangways clear are of no great avail if the flow of production is uneven to the extent that existing gangways are inevitably cluttered up at intervals. Are there white lines marking gangways, in which nothing may be left or into which nothing may project? Is the foreman one of the old-fashioned sort.
who repeats constantly that they did not go for first-aid for scratches when he was a young man? What steps are taken about the man who has discovered a quicker (but unsafe way) of doing a job? What is done to encourage a worker who has discovered a safer way of doing a job?

People have to be trained to think correctly about these and many other apparently simple matters if good standards of safe practices are to be reached. It is the study of matters of this kind which provides the basis for safety training. These are the first stages which must be accomplished before the more difficult matter of trying to discover the true causes of accidents can be tackled. They are matters which will only receive proper attention if it is known that they are part of the active policy of the top management, who will require an explanation if there appear to be any serious departures from that policy.

The Basis for Guidance

The principles and examples quoted in this chapter indicate some of the first steps which have proved successful in building up good standards of safe practices in many industries. To many they will merely represent a repetition of the obvious but they are the essential foundation without which no safety organisation can succeed. As such they should be of immediate interest where industries are being planned or are being developed. Also, these examples provide a basis for the guidance and information supplied from the central sources - governments, government departments, trade unions, manufacturers' associations, voluntary safety councils, which should, in the economy of all countries, have as part of their function the establishment of safe practices.

Establishing the Real Causes of Accidents

The next advance is to find out the real causes of accidents, and to plan the campaign for safe practices accordingly. This is a very different and much more difficult matter than the classification of accidents under types as indicated elsewhere in the present chapter, and more particularly in Table I. A simple example is that the type of accident may classify itself obviously and immediately under "falls of persons on the level", but the cause of the accident may be one or more of a dozen or 20 errors or omissions.

Until a system is established to determine the causes, no great progress can be made from the early stages to which reference is made elsewhere in the present report. A number of safety organisations have failed to develop beyond this type of programme for various reasons. The only reasons which need concern us here are:
(a) the amount of time involved; and
(b) the somewhat devastating frankness essential to a correct analysis.

The advanced industries have learned, sometimes painfully, that no progress results from being vague or imprecise. Death, mutilation and serious damage are the matters in question. Diplomacy and a polite regard for personal feelings will not prevent disasters, injuries and wrecked plant.

Further, the establishment of a system designed to pinpoint the real causes of accidents - and it can only be a slow progress is one for the individual concern and even more the individual works, on a basis of increasing confidence and co-operation within the works. The object of any accident inquiry in a works should be solely to prevent that kind of accident happening again. Gross carelessness or blatant disregard of regulations are both very rare when people have been properly trained. They are swiftly self-evident in a well run works, and are usually equally swiftly dealt with under the normal works discipline procedure. It is clear, therefore, that systems of the kind under discussion cannot successfully be organised or enforced by central organisations such as governments, trade unions and associations, though they render good service by making general information and existing experience more widely known. There is no further need to labour the point except to state what is obvious from experience of complex industry - that it is very often possible for the real cause of an accident to be concealed.

An Example of Analysis

An example of a far-reaching analysis is quoted from one large section of the chemical industry in which the accident rate has been reduced by 90 per cent. in about 30 years. All lost-time accidents1 are analysed as follows:

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1 A lost-time accident is defined as one which causes loss of working time beyond the day on shift on which it occurs.
Design, Construction, and Operation | Supervision and Training | Personal
--- | --- | ---
Faulty design and layout. | Failure to provide suitable protective equipment. | Failure to use suitable protective equipment correctly.
Inefficient light, heat or ventilation. | Inadequate supervision. | Breach of instructions or rules.
Faulty operational methods. | Inadequate training. | Unsafe attitude.
Mechanical failure or failure of materials. | Inadequate rules or instructions. | 
Inadequate guarding of machinery. | 
Inadequate maintenance. | 
Faulty design of protective equipment. | 
Miscellaneous. | 

It naturally takes years to build up the basis of confidence on which such an analysis can only be based, but at the end of the inquiry there is not much doubt as to the real cause of the accident. It should be re-emphasised that the inquiries are not for the purpose of allocating blame. Their purpose is to prevent a recurrence of the accident.

A Second Example of Analysis

Another classification often used is as follows:

**Design**

1. No equipment provided.
2. Inadequate equipment provided.
3. Improper equipment provided.
4. Layout of job wrong.
5. Physical conditions wrong.
6. No safety equipment provided by management.
7. Inadequate safety equipment provided by management.
8. Improper safety equipment provided by management.
9. No instructions (method).
10. Inadequate instructions (method).
11. Wrong instructions (method).
12. No safety instructions.
13. Inadequate safety instructions.
14. Wrong safety instructions.
15. Inadequate maintenance (method).
16. Inadequate training (methods).
17. Inadequate selection (methods).
18. Inadequate supervision (methods).

Supervision
1. Method misunderstood.
3. Method not passed on.
4. Method not detailed.
5. Method insufficiently detailed.
7. Method not enforced.
8. Understanding not tested.
9. Safety equipment not available on job.
10. Inadequate safety equipment on job.
11. Use of safety equipment not enforced.
12. Job not studied.
13. Environment not studied.

Personal
1. Instructions misunderstood.
2. Failure to obey instructions.
3. Refusal to obey instructions.
4. Lack of knowledge.
5. Lack of experience.
7. Loss of skill (temporary).
However much these lists are expanded by different users, their expansion should result from the splitting-up of each of these causes, so that a general inquiry for information connected with causes can be answered on the same lines by reconstructing the list of causes in its original form. For instance, if "Bad Housekeeping" or "Rendering safety devices inoperative" or "Allowing dangerous work without warning workers in vicinity", were added to any list as a general heading, the uniformity would be destroyed. They could belong to either group. In short, they refer to a result, not to a cause, and so belong to a different method of analysis.

The foregoing deals with the methods which must be employed. In some cases great difficulty is encountered both in discovering the full history of an accident and in arriving at correct conclusions from sketchy or indecisive evidence. In other cases, however, the comparatively simple inquiry and report made by the supervisor reveals the basic cause of the accident. Nevertheless, the responsibility for discovering them cannot be removed from the safety officer.  

It is clear that audio-visual aids can be well employed in inculcating safe practices under each of the above headings. The experienced trainer will obviously design or adapt his aids to the special circumstances.

Obviously a scheme of analysis of this nature cannot be suddenly installed in a rush of enthusiasm. Many years have to be spent on the task by many people, and it cannot be emphasised too strongly that most of this effort goes into building up a foundation of mutual confidence. The first stages in the safety training, of which a sketch is given elsewhere in the present report, must be not only accomplished first, but must be pursued all the time. If that part of the programme prospers, the second part, which will eventually prove not so intimidating and embarrassing as it first appears, can gradually be brought to full life. In the end, the majority of the personnel become convinced of the management's policy and sincerity, and it may be noted that there are many instances where the wide appreciation of the safety policy makes a specific contribution to good labour relations.

Investigating All Lost-time Accidents

At first sight the problem of investigating all lost-time accidents (as already defined) on this scale may sound a big one. Actually, such a scheme can only be operated after some years of effort in the first stages and when the time comes the number of accidents is relatively small. For example, in one large concern,

accidents in the early stages were about 80 per 1,000 employees in 1930. About 20 years later, the war having intervened, when accident analyses were gradually adopted, the rate was about 30 per 1,000 employees; in 1960, nine accidents per 1,000 employees. The work involved, from the point of view of numbers, is not great.

The importance of analysing at least all lost-time accidents arises out of the fact that the effect of the accident is often a matter of chance. There may be no personal injuries or the injury may be very slight. One of the thoughts behind searching analyses is that a small change in conditions might easily have resulted in death or serious disablement or serious damage to plant.

The Reaction of Managements

The tendency for managers to become more severe with themselves in respect of their own responsibilities is also worth mentioning. "Human failing" and "unsafe attitude" as accident causes are becoming fewer in proportion as managers are able to make deeper studies of the training - or lack of training - received by the injured person in relation to his work.

A study of the real causes of accidents on the lines indicated in this chapter reveals a wide field for education, training and research into vital matters of which safe production and practices are only a part - though an essential one. All the strictly technical aspects of design, construction and operation, all the art and practice of management and supervision and personnel relations come into review. Moreover, they are considered systematically at the highest level for, obviously, only the highest authority in a works can confirm verdicts arising under most of the headings which have been quoted. Some of the ways in which training and guidance can assist in searching for the real causes of accidents are indicated in Chapters III and IV of the present report.
CHAPTER II

SOME AUDIO-VISUAL AIDS: A CRITICAL SURVEY

Functions of Audio-Visual Aids in Training

Audio-visual aids to training, instruction and reminder are media which, by using the senses of hearing and sight—especially sight—help to pass on knowledge, skill and attitude to those whom it is desired to train or influence. The actual seeing is the important thing, whether it be the constant sight of, and contact with, a good foreman who gets the best from his men, or the aids as ordinarily understood—models, films, chalk-boards, posters and the like.

As far as these aids are concerned, it can be stated with confidence that what is learned is learned:

(1) By methods which stimulate and create interest.
(2) More accurately.
(3) More quickly.
(4) More permanently.
(5) With more emotional impact.

The petroleum industry, widely distributed geographically, has a special experience of these methods in training. Headings quoted from an excellent short guide are:

(1) Induction of new staff.
(2) Operator training.
(3) Artisan training.
(4) Lectures to advanced technical staff.
(5) Supervisory training.
(6) Refresher courses.
(7) Safety training.
(8) Employee communications.
As this report indicates, the teaching of safe practices enters into all these subjects and should, generally, be included as part of general training, rather than isolated as something special.

The petroleum industry's survey re-emphasises the warning that what is to be aided must be set out in detail, and only then, when something concrete exists, can these aids be considered. The aids can support, but can never supplant, the human organiser and trainer.

Some of the many aids available are listed below, with comments.

**Posters**

In too many places of work there are too many notices and posters of various kinds displayed on the walls and on notice-boards, mostly defeating their own object. As far as a drive to improve safe practices is concerned, an excellent step is to remove as many of these as possible, and to utilise a small number of carefully selected sites, made specially attractive, for safety publicity. Rigid and regular inspection of such sites, with frequent changes of content, are essential. An unkempt safety poster board or a torn and dirty poster creates a deplorable impression.

A good scheme with posters is to encourage local works talent very occasionally, but to rely in the main on designs produced by first-class poster-artists whose work is, or should be, available through central organisations at low prices per poster. Large industrial organisations can, and do, supplement supplies from a central source by posters of their own design. If they are wise they will use their publicity, public relations or advertising departments and firmly discourage the enthusiastic amateur and critic. Selection of posters may be profitably applied to two kinds:

1. That which conveys its message in a second or two; and

2. That which contains a brief message which has a fair chance of being read because of existing good standards of safety in the works concerned.

What has been stated above about posters assumes a fair degree of advancement and experience. There are countries and industries where the development of what are called modern facilities is in very early stages. Probably also the characteristics, colours and clothing of the people bear little or no resemblance to those depicted on posters and other visual aids more freely available from other countries. The exhibition of aids from
foreign sources in these circumstances is generally useless, puzzling or even sometimes fiercely resented and should be strictly avoided even if it appears to provide a ready-made and cheap solution. In passing, it can be stated that such aids, exhibited in the wrong country, or even the wrong industry, often do harm to the country or industry of origin.

Such use as is possible must therefore be made of local talent and facilities, even though the aids, especially posters, may not in the beginning qualify for international awards. Agencies and people are available, though hard-pressed, from technical aid and other schemes, but the vital thing is that the organisers on the spot should study the subject and use their own talents. One of the best short statements on posters by a famous artist has served as a guide to many who already think that they know what is wanted.\(^1\) It was published under the auspices of U.N.E.S.C.O. Opinions differ sharply about the writer's opinions, which is all to the good. The question is "What is right for the conditions in any country or any industry?" The wrong answer is generally received when judgment is exercised on the basis that something has succeeded elsewhere.

The brief principles given at the beginning of this note are good in any circumstances. The poster must convey its message in one or two seconds. That means it must have a fair chance. It must be displayed in a special place where people expect to receive a message. It must be clean — not tattered or worn or torn at the corners. It must not have to compete with other notices. It must relate to the people who see it and not to any other race of people. Whether it is horrific or severely stern or plain commonsense or humorous must be decided from local knowledge as to what has the desired effect. The personal proclivities of the organisers may have to be sternly repressed — they may be quite different from what achieves the best effect among the workers whom the posters are intended to influence.

Safety Notice-Boards

Every works should have one very large board solely for safety propaganda purposes placed in the most advantageous position, usually near the entrance. These boards should not be used for posters and notices but should be utilised for special campaigns, safety weeks and the like and for recording, in very large figures,

or by graphic representation, accident records, frequency rates, days free from accident. The essential is change, even to the extent of removing the board altogether at intervals. Some examples are shown in the illustrated section of this report. Such large boards need not be expensive. Indeed it is better to spend a comparatively small sum of money with the idea of erecting a different form of board or hoarding within a short period.

In the United States and Canada large "Jumbo-size" centrally-published posters are used on sites of suitable size. They are most effective but are only possible where there is a large potential sale.

Smaller safety poster-boards in good sites are valuable if severely restricted in number and maintained in new condition in places where they have no competition from other notices. Provided they are kept clean and freshly painted they can be simple and economical if the conditions of climate and the atmosphere of the works are good. In such cases the posters should be neatly and firmly fixed in a simple frame, not with drawing pins, etc. The appearance is much improved and damage from wind or mischievous youths minimised. In wet climates out of doors and in works which may still be exposed to dust and fumes, a rather more elaborate poster-board with a glass-door hinged front, fitted with a lock, may be necessary. It is often not easy to maintain poster-cases of this type in clean condition; a regular routine is essential.

Mixed boards, including perhaps extracts from legal or factory requirements, recreation-club notices, etc., are not advised for use in safety publicity. They should be avoided wherever possible, even in small works, to eliminate competition from other posters and notices. In commercial poster display, the advertiser seeks a solus site. He has to pay heavily for it, and expenditure of this kind is not generally incurred unnecessarily in business. A live safety organisation can obtain its solus sites without extra cost to the firm.

Safety Trophies

Trophies, some of them very handsome, are frequently awarded for long periods free from accident, and this is a good idea if sufficient publicity at high level is given. These trophies should be well displayed in weather-proof housings where the workers can see them or moved at intervals and displayed in the different departments.
Warning Notices

Temporary warning notices such as "Danger - men working overhead" refer only to temporary conditions. If there is some marked change from general works routine, the safety organisation must ensure that proper warning is given in this manner - and also that the warning notices are removed when normal conditions return. Such measures simply imply the degree of watchfulness which is always essential in a works.

The question of permanent notices to inculcate safe practices and to avoid risks is a most difficult one which must be solved in every individual factory. One good principle, where there are statutory rules based on legislation, is that such notices should be restricted to those required or indicated by law, e.g. "No matches, no smoking, no naked lights", or "The safe speed of this grinding wheel is 1,800 revolutions per minute: this must not be exceeded. The metal guard for the grinding wheel and the transparent shield must be in position. The tool rest must be close to the wheel and at right angles. Side grinding is prohibited." A wordy notice, but, in one way or another, the rules must be made plain or disaster may result.

On the other hand, permanent notices are to be seen such as "Mind your head", "Beware of traffic", of which the workers soon become oblivious and which in any event reveal faults in design and construction or failure to provide proper guard rails. A good principle is that permanent warning notices are no substitute for good training, good design or good guarding. They should be kept to an absolute minimum - and also kept clean as a matter of planned routine.

The Use of Colour in Factories

Colours are much used in some works to indicate dangers, to give warnings and to indicate contents, e.g. of pipelines. Opinions about them differ greatly. Bright, cheerful colours are naturally preferred as far as general decoration is concerned and are to be seen in most modern chemical works. Apart from that aspect there are to be found machine-guards, transmission guards, guard-rails and wire fences, etc., painted red, as are the fire-fighting appliances and the wall-boxes containing protective and first-aid equipment. On the other hand, in a large laboratory and semi-technical plant which has a remarkable safety record and is a model from every practical point of view, green is used in the place of red. This colour has been adopted also by other factories in the district and in the technical schools where young people receive vocational training. The important thing is a specific colour on a guard should be recognised as a warning.
that the guard must not be removed without authority or only by a qualified person such as a tool-setter. The colour should also be accepted by all in the works as an instruction that the machine must not be run without its coloured guard except for lubrication, adjustment or maintenance by an authorised person, such as a registered machine attendant. These principles recommend themselves in countries where legislation on guarding dangerous parts of machines is strict and, also, where industries are in the early stages of development. In the United States and Canada, however, many factories operate, successfully as far as low accident rates are concerned, with a lighter standard of guarding as compared with Western Europe. It is also customary in many instances for the machine operator himself to lubricate where necessary, to re-set tools and to do some maintenance work himself. It has to be remembered that these methods have been developed over many years by the North Americans, who are highly individualist in character and have a high degree of mechanical aptitude after a few months' experience.

Colour codes for pipelines containing gases and liquids have their protagonists. Their opponents generally prefer markings with the name of the contents. In any event, all work on pipelines in the chemical industries must be done by trained specialists or under strict supervision by a literate and qualified person. Any relaxation of this rule will certainly lead to injury and disaster.

Lines to indicate traffic space in gangways are usually regarded as essential; paint is mostly used. Attempts were made at one time to give warning of floor-openings, etc., by lines painted on the floor. This met with disfavour; proper guard-rails, fixed or portable, are required. They should be painted in warning colours.

In summary, practical experience indicated that standardisation is difficult even in one concern with several factories, if some freedom of choice exists. Opinion differs so much that attempts should be made not so much as to insist on standard colours but to ensure that the works concerned installs its own system of danger warnings.

Incidentally, a substantial proportion of people have defects of colour-vision.
Realistic Visual Aids

"Real-Life"

The most direct and most often used aid is on the job, where the actual machinery or chemical plant, demonstrated expertly, grips attention as probably nothing else can. The difficulties are obvious — the demonstrator may not be able to make himself heard; the process itself proceeds unseen inside vessels and pipes. At the same time all possible opportunities should be taken of giving instruction in safe practices in the actual place of work. This applies particularly to newly-engaged young workers and other shop-floor employees and can be directed not only to machines and plant but to the general hazards which cause most accidents. Dangers from untidiness, obstructed floors and gangways, faulty or untidy maintenance and construction methods, loads on gantries, cranes and other lifting tackle, conveyors, traffic — internal and external — the location of fire-fighting apparatus, gas-masks for emergencies, etc., are all best introduced to the worker on the shop floor. (See illustrated section of the present report).

Fire fighting and the use of emergency apparatus are also demonstrated with real fires, real gases and in vessels and confined spaces. Correct emergency action is often vital in chemical works. Many workers have lost their lives or have been seriously injured through incorrect methods of fire-extinction or attempting, without using the correct breathing apparatus, to rescue a fellow-worker from a confined space which contained a dangerous concentration of gas.

Risks peculiar to the plant or process can sometimes be demonstrated, especially the effects of corrosion which is inherent in some processes. There are many instances, for example, where only regular inspection reveals the almost complete disintegration of a vital handrail under its coat of paint.

"Off-the-job"

Off-the-job training is regarded as essential in modern industry for youths and newly-engaged employees and most of the apparatus used are of considerable interest to more experienced workers who may have acquired practical knowledge of their special jobs over a period without specific conference-room training. "Real-life" aids should be used where practicable; they are often most effective when demonstrated in the lecture room. Processes of chemical manufacture can be reproduced or simulated in glass apparatus of the kind used in semi-technical plants and samples of the final and intermediate products shown. Cut-aways of
plant, machines, valves, pipes, flanges, etc., can be used. The
collection and correct use of personal protection - safety
helmets, goggles, face-masks, breathing apparatus, safety boots,
special clothing - can be demonstrated. Safety equipment that
has saved lives or serious injury - helmets, goggles, safety
boots - always attracts attention. A "Chamber of Errors" showing
worn, damaged and dangerous tools and equipment is also effective.

Models

Some items are too big for full-scale off-the-job training
and can be replaced by small-scale models, whole or cut-away,
manipulative or still. Examples are distillation columns,
large pressure vessels, centrifuges, factory or plant layout.

Other items are too small for convenient demonstration and
can be reproduced on a large scale. Examples are gauge-dials,
temperature recorders, automatic counters, special small guards
for machines, small apparatus for giving warning of fire or
temperature rise and gas detectors.

"Mock-ups"

A form of model which, while not actually resembling the
thing closely demonstrates the principle, e.g. laboratory-bench
demonstration of chemical processes using glass apparatus,
molecular models, miniature dust explosions, principles of gravity
conveying, mechanical and manual weight lifting (See illustrated
section of the present report).

In considering the making and use of models, it is necessary
to realise that they are usually fairly costly and that their
storage and handling can present difficulties. A possible solu­
tion may be, if space is available, to install them on a permanent
or semi-permanent basis and to use them as exhibitions as well
as for training purposes.

By reducing three dimensions to two, these major drawbacks
can be reduced, but there is a corresponding loss of impact.

Blackboards

This item is one of the oldest and one of the best, with a
good instructor and there are many types for various needs: the
simple board, the sliding panel, hinged panel, roller-type boards
which include a cine-screen and boards with figured surfaces for
graphs and scales, etc.
The blackboard has many advantages, such as:

1. Versatility.
2. Colour.
3. Is easy to handle and takes up little space.

But it has also disadvantages, for example:

1. The instructor must be skilled.
2. Some drawings take much time to prepare and are not permanent.

When it is desired to "build up" a complicated drawing or to produce a number of drawings at one time on a chalkboard, the usual advice to any but the most expert is to prepare the board carefully before the lesson or talk and then almost erase it. The teacher can see the faint outline but the audience cannot. This precaution ensures that the finished drawing will fit the board and be a good shape.

Technical words, key words and definitions are given extra force if they are written on the board when they are used, especially if the audience is expected to make notes. They should be erased when they have served their immediate purpose, unless they form part of the summary. Anything, in fact, written on the board should remain only as long as the audience is using it. The transience of chalkboard teaching gives emphasis to the dynamics of the learning and provides scope for the summary which is the focus for recapitulation.

It is difficult to generalise over so versatile an aid, but it should usually be planned in advance and cleaned when not in use.¹

Tear-off Sheets

A pad of newsprint or other large-size cheap paper on which the instructor can draw with a wax crayon. Each sheet is torn off and set aside for future reference or posted up for further study. The blackboard can be reserved for quick temporary visuals while tear-offs can be used for recapitulation. A fair degree of skill in drawing quickly, as well as in speaking and teaching, is obviously necessary in using this aid, which is best suited to one short subject or aspect in teaching safe practices to industrial workers as a part of a longer session. The blackboard device mentioned above can be adapted in that the drawing may first be completed in pencil and rapidly filled in with the coloured wax crayons.

Flip-sheets

Flip-sheets are large sheets of paper on which drawings, charts and wording are drawn in advance. Six square feet is about as much as can be handled conveniently as the principle is that as the subject matter on each sheet is dealt with, the sheet, which is one of a series attached together at the top, is flipped over the blackboard or similar display arrangement to reveal the next aspect of the subject. It is claimed that the trainer is able to present the sheets one by one so that each trainee can concentrate on the point under discussion without being distracted by what is to follow. Subsequent comparisons can be arranged between the sheets on a given subject, the sheets being removed from their temporary "loose-leaf" binding and displayed, for example, on the walls of the lecture room. The system has advantages when illustrating a subject which is being presented at intervals to new audiences. The drawings and wording must be very clear to be readable and colour is advised to attract extra attention.

Safety posters can be fastened together in this way to provide material for discussion on their merits and de-merits, their suitability for display on the works or in particular departments. Short sessions of this kind are valuable for meetings of supervisors and foremen, works councils, safety committees and the like. Opinion about safety posters differs, sometimes sharply, and the safety organisation must be prepared to engage in debate at such meetings.

Safety-graphs

The "Safety-graph" is a portable smaller device of the "flip-over" type (size about 2' x 1'6" (60 x 45 cm.)). The drawings and wording are bold and colour is used effectively. The illustrated sheet faces the audience and the brief talk, relating to the sheet which is visible to the class, is printed in large type on the side facing the lecturer. He simply reads what is printed. "Safety-graphs" are valuable for small groups up to about 16. They ensure, to a great extent, that the subject matter is presented in a correct and logical way as they have usually been designed by publicity experts. They also provide experience in lecturing for supervisors and foremen who might otherwise be nervous of talking to groups of workers on some safety subjects. Apart from verbal instructions and a short practice provided by the training or safety organisation, carefully worded and explicit standard instructions are printed at the back of the first sheet of the "Safety-graph" and there is not much doubt that anyone who has risen to the rank of assistant foreman can deliver a lecture which will be remembered by his audience for some time.

Some firms have produced their own "Safety-graphs", including several with the co-operation of their joint safety committees. This is expensive in the first instance but is good value in large organisations.

**Pin-ups, Flannel-Graphs and Magnetic Boards**

The pin-up is a series of parts of a unit which are pinned up and discussed in sequence to form a complete presentation. The reverse process can be used to reduce a subject to its essentials. The flannel-graph comprises a special felt-faced board on which pieces, also backed with felt, illustrative of the subject are placed, apparently defying gravity. It attracts much interest if not used too frequently for the same audience. The magnetic board is similar in operation and is specially useful in demonstrating flows of material and traffic. The roads, gangways, etc., are drawn on the board, using small models of vehicles, containers and the like to illustrate movement, density of traffic, bottle-necks, and possible accident points.

All the above are useful in giving lessons and off-the-job training in the sequences which have to be followed in an efficient and safe operation in a chemical works. For example, where the process ends with filling and closing a small or medium-size package - whether it be a box, drum or cylinder - transport to the temporary storage place, stacking, unstacking and loading for further transport, the different stages in the work can be illustrated to small groups. A short training session with the workers concerned can provide instruction and guidance not only how to do the job, but why it should be done in that way and not in any other way. Much is gained by telling workers why as well as how.

**Photographic Aids**

**Photographs**

A good photographer can be a valuable asset in any factory where there are facilities for posting up much enlarged photographs, publishing pictures in the works magazine, passing prints round at small meetings or providing material for projection. Good and bad practices, tidiness and untidiness can be readily illustrated. Sequences of operations can be demonstrated. Accidents can be reconstructed in many cases. Photography in its various forms is a potent aid in safety weeks, special campaigns, etc., when the readiness of the personnel to be interested
in safe practices is greater than usual and when there may be some form of competition with small prizes. Good photography is, of course, necessary for projection slides and film-strips.

After-hours Camera Tours

Large or small departures from safe-practices can be discovered in any works. Shock treatment can be administered by taking good photographs of bad practices after general work has ceased. Large photographs can be exhibited instead of the usual posters or the pictures published in the plant journal.

Projectors

The main requirements of a projector for still pictures and film-strips are that it should have a powerful source of light and that it should throw a big picture. Professional advice in the purchase of a projector and screen should be obtained.

Slides and Film-strips

In the projection of still single pictures as well as film-strips the lecturer provides most of the "audio" and he must necessarily be fairly fluent and well rehearsed. Projector sessions should be short, certainly not more than one hour if group discussion is included. It should be considerably less if there is no discussion or, preferably, if the projector is only part of the programme of the occasion. Except in lectures to professional safety and other staffs, or when projection is used to demonstrate works practices and conditions to supervisors and foremen, either actual or in training, still projection has often not much appeal unless used for "case studies" in small classes with plenty of discussions among the audience.

Valuable opportunities are being lost by failing to use colour-slides and film-strips, which are now easy to produce if the correct lighting is available.

Slides or single transparencies are generally not so convenient to use and always occupy more storage space than film strips. However, they have their advantages. They can be kept in better conditions by being enclosed by glass, they can be used singly as units and their order can be re-arranged to illustrate different lectures or talks. A powerful projector with full automatic operation and remote-controls changing device is the best instrument as an aid to training.

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1 See the section on Safety Weeks in the present chapter, p. 62.
2 For a good example, see National Safety News, June 1961, Chicago, U.S.A., p. 49.
Film-strips are convenient to use, with a good machine, and can be stored and rolled in a very small container. They must be handled with care and it is wise to have some duplicate copies if they are used frequently.

In both cases, the text of the spoken words for the "audio" part of the display must be carefully matched to the pictures, the spoken text being as near as possible the same length for each picture.

The biggest capital expenditure is for the projector, which should be the most efficient obtainable for the funds available. Many projectors will handle single frames and film-strips with equal efficiency and this type is to be preferred. In dull climates the second most expensive item of equipment is a powerful electronic flash. This, with practice will give good results in colour and well-contrasted films in black and white in almost any circumstances if the subject is well-chosen and has good photographic colours. In sunny climates colour photography now presents few difficulties, though care has to be taken in the development and care of the transparencies. The impact of colour is much greater than black and white where teaching and training are concerned and is advised whenever possible.

Provided its construction is suited to local climatic conditions, the camera need not be of the most expensive kind. Where the transparencies and film-strips are being made with local talent - which is perfectly possible and often preferable - good pictures can be taken with a low-priced camera if there is enough light. A good light meter, arrangements for developing, mounting and joining the transparencies complete the equipment.

This note enters into some detail because transparencies, either single or in film-strip form can provide an economical and valuable aid once the initial capital expenditure has been met. As such they can be recommended where budgets for training are restricted. Where there is no main electrical supply a transportable generator is necessary, as for all the forms of projection described in this report. In such cases a transportable generator is obviously of value to the central authority for purposes other than training in safe practices. Car batteries can be used if this is impossible. The light is not very good and the audience can only consist of a few persons close to the screen.
Single transparencies and film-strips are available from many central services. They can provide useful ideas but are naturally most suitable for showing in the country of origin. They should not be used for public showing where the people and conditions are different from those displayed. They should reproduce local conditions as closely as possible and in the factory itself if that is practicable.

Apart from illustrating safe practices in an attractive manner which can be matched to the characteristics of the audience, they are much used in case-studies which present a sequence of pictures illustrating a problem and end with the questions to the trainees "What would you do"? or "What was wrong in this case"? An example could be devised showing a sequence of accidents involving a worker who appeared to have little regard either for his own safety or that of his fellow workers. At a foremen's meeting or training course, the usual question is "What would you do"? and the answer would vary from recommendations to dismiss the man from the firm, attempts to have him transferred to another department, warning the man of his conduct and example, inquiries into any accident on his record or an attempt to discover what training the man has had.

An example of a film-strip showing safe practice is shown in the illustrated section.

Recorded sound and commentary can be used for film-strips, and often attract attention as an unusual and ingenious device. Tape recording is relatively simple and can be arranged to "fit" the frame by suitable timing and the insertion in the recording-tape of signals to change the slide. Another system uses a disc record converted from a tape-recording. The idea has the advantage of standard narration and the apparatus is readily portable. This equipment can also be operated from car batteries but then has the same disadvantages as a silent projector accentuated by the extra demand for power by the audio side.

**Overhead Projection**

Several makes of "overhead" projectors are now available. They have some important advantages of which three are (a) the lecturer can face his audience, (b) the hall or lecture room need not be darkened, and (c) movement of the material projected is easily possible. Generally, transparencies are placed over a glass panel illuminated from below. The image is projected upwards through a prism and lens over the speaker's head to a screen behind him. The speaker can operate the projector himself, which he usually does, or he can use an assistant for quick changes or for movement.
By overlaying transparencies, drawings and charts can be built up on the screen. Twelve or more such transparencies can be used in succession and provide a clear image in a lighted room if the light source of the projector is powerful. By covering the transparencies with a sheet of opaque material—ordinary typing paper is completely effective—the image can be entirely obscured to conceal information until it is needed or movement of the opaque material will convey information of consecutive processes, growth in chart form, etc. Some machines incorporate a roll of transparent material over the glass, making it possible for the lecturer to write with wax crayons or special ink pens. The projector then assumes the functions of a super blackboard and the roll can be turned backwards for recapitulation or discussion purposes.

At a recent conference and display a drawing in chart form was shown of a suction-type defueling system. By rotating a stroboscopic wheel in front of the lens, movement was imparted to the fuel in the pipes—a simple device of special interest in some forms of training for work in chemical industries. Some working models of transparent plastic can be shown and some chemical reactions demonstrated such as precipitating clear solutions in a shallow transparent plastic dish.

This type of projector needs a practised speaker and operator. It is bulky and needs careful packing and transport. It is suitable for large firms and central organisations who can arrange for its frequent use in skilled hands. In these circumstances it is a valuable aid.

Opaque Projection

Opaque projectors (Epidiascopes, etc.) are less used than formerly because of the variety of other types of projector now available. Nevertheless, many experienced trainers continue to use them and speak highly of their value and versatility. They will project printed and coloured sheets from papers, periodicals and books as well as well chosen three dimensional objects and textured materials. No special mounting, slides or transparencies are required, though ordinary slides can be used with an adaptor. There are no moving parts.

Its disadvantages are that it is bulky and needs a darkened room. A very powerful light source is essential.
Dealing first with industries which have passed the first stages of development, good advice is to use films only in moderation and to make them good and short. They should either be professionally made or should be modest amateur productions relating to the people and the actual factory where they are shown. Most attempts to compromise between these two extremes have not been good as far as the teaching of safe practices has been concerned. The hard fact about films is that a good one is very expensive — up to £10,000 for a colour-sound film running for 20 minutes (which is probably too long). In a large organisation, where such a film may be seen by scores of thousands of the firm's employees, besides being shown in other firms with similar problems, at the many meetings concerned with industrial safety and at film festivals in different parts of the world, the cost per audience-member is not great and considerable prestige-value is gained. The same considerations apply to the colour-sound films produced by some governments. Where there has been a fair development in safe practices achieved by some of the methods outlined in this report, a reasonable conclusion is that the production of such films is worth while at, say, intervals of five years, in relation to a particular large firm, or industry, or a general subject such as suitable clothing for women operating machines. That assumes that finance is available and that the potential audiences are large enough in total to reduce the cost per head to a reasonable sum. If a £10,000 film is shown to 100,000 or 50,000 workers and carries a reminder of the necessity for care and safe practices to them, the cost per head is low enough to justify the money and effort spent.

Good professionally produced black and white films cost from one-half to two-thirds of the price of a colour film of equal length. For safety purposes they are no longer advised in countries when entertainment films in colours are commonly shown. In places where entertainment films are seen rarely, an economically produced black and white film, even if silent, should be of considerable interest to the audience as long as the characters and conditions are not foreign to their own circumstances. The trainer or lecturer himself can provide a spoken commentary in the local language, probably at a second showing of the film. It cannot be re-emphasised too frequently that the showing of films from developed countries to workers in the developing countries is usually ineffective from a safety angle and harmful in other aspects.

1 The Government of New South Wales, Australia, for example.
Up to this point, this note on safety films is a counsel of perfection. In the last 40 years many film efforts which would now be regarded as somewhat primitive have been made with excellent effect at the time. The limiting factor was mainly economic, industries being either unable or unwilling to authorise anything but a small budget for safety purposes. In many developing and partially-developed countries, the amount of capital available naturally restricts the use of the aids, including films, dealt with in this report. This is not altogether a disadvantage as it almost compels the new industries to invent and adopt methods which are really suitable for their special circumstances. If, therefore, it is decided that safety films can help to improve the standard of safe practices, a central organisation in the country concerned can usually produce films which fit the purpose. It may be noted that a variation of the same principle is used in quite small individual works, where modest amateur films have been very useful adjuncts to safety weeks and similar propaganda programmes. The sight of their own workmates on the screen more than compensates for the obvious lack of professional technique. In one instance an 8 mm colour film, with tape-recorded commentary showed the improvement effected, at small cost, in providing a safer method of disposing of broken glass, bottles and containers in a pharmaceutical factory. This arose from the works' suggestions scheme. In another case, the early work on the study of safe-handling methods in chemical industries was aided by amateur cine-photographers about 30 years ago. There is still much opportunity of conveying short simple lessons in this way at little cost. A recent development is that a sound track can now be added to 8 mm colour films.

However, all attempts at education and training must be related to the conditions of life as a whole. As already stated, some successful steps in creating a reasonably tidy and safe place of work must precede the production of safety films. Equally, the conditions of people outside their working hours has to be taken into account. To produce a film on works safety addressed to employees who, for example, may be constantly exposed to a tropical disease or infestation seems to imply that something is missing in the social programme. These are aspects which can only be influenced by governments and strong central agencies.

Television

General Programmes

In some countries it is possible for a central organisation to secure short periods of time, free of cost, in which safety in its different aspects, including industrial safety, is brought to the notice of a huge audience which expects to be entertained
rather than instructed. This approach has an element of surprise and shock, which is sometimes good but must be used with discretion at infrequent intervals.

Closed-Circuit Television in the Works

In industry there is an increasing use of closed-circuit television for maintaining a watch on processes which may become dangerous, as in explosives manufacture, and in relation to which it is desirable to have no personnel on the plant, which is often operated by remote control. While not actually teaching safe practices, the method is a constant reminder of the need for continual watch and care, as well as being evidence that the manufacturers have learned the wisdom of safe practices. Processes which are difficult to watch, although not specially hazardous, also lend themselves to this technique. Closed-circuit television is used as an aid in the control of traffic in some public places. There seem to be opportunities of improving the control of the movement of production items and works traffic, dealing with bottle-necks, etc., and so adding to safety and efficiency.

There is a promising future for closed-circuit television for off-the-job training where conditions in the works can be reproduced on a large screen without the distraction of noise. The increasing use of coloured closed-circuit television for demonstrations from hospital operating theatres is a pointer.

Closed-circuit television has been used in works' safety weeks, chiefly to enable visiting and local notabilities, safety committee members and others to address the works personnel in canteens. The novelty attracts attention but time has to be allowed off from work in order that the speakers should not have to compete with the noise of cutlery and crockery. The largest and brightest possible screens are required for best effect.

Class to Class by Television

A recent successful experiment\(^1\) shows that it is perfectly practicable for one teacher or trainer to provide instruction and initial discussion and questions, not only for his own group of students but for another group which may be several miles away. In this experiment, a school master teaches his own class, using apparatus to demonstrate. He faces not only

\(^1\) The Hayes and Harlington Closed-Circuit Television Experiment. (London Central Office of Information).
his pupils but two small industrial television cameras, one of which televisuals him, his desk and the blackboard. The other camera is used to enlarge small objects and to give close-up views of demonstrations. The second class is provided with a 27-inch television receiver. The departure from ordinary television techniques is that, by suitable switching of sound, answers and discussion in both classes can be heard by each and that calls for information and answers can be made by each. An additional microphone is in each classroom and is fitted with a two-foot parabolic dish. This can be aimed at individual pupils from the front of the class and will pick up remarks without either pupil or teacher moving from their places.

Sound is conveyed by public telephone circuit and vision by micro-wave link, a very efficient and low powered line-of-sight transmitter.

A technical assistant is required at the transmitting end.

It seems probable that developments of this kind will find their industrial training uses. Apart from the advantages of one capable teacher handling two classes, with questions and discussion included, it is perfectly possible technically for one central talk and demonstration to be received by ten or more classes if required. There could be no immediate contact between the chief lecturer and the classes in such a case, but questions and points for discussion could be collected from class leaders or teachers in the receiving classes and dealt with at the following session. Such a system as envisaged seems to have advantages over films in that the subject can be kept up-to-date and there is some personal contact even though it is delayed until a later session.

The present objection to television for training purposes is that of capital cost. The class-to-class experiment described above would cost up to £10,000 for installation but it is stated that a larger system for more classes would cost progressively less per class. Mass teaching is not well regarded in some countries, but in a modern fast moving world, the principle must be examined without prejudice.

Speeches, Addresses, Lectures, Lecture Notes, etc.

From Top Management

A most potent aid comes from the top, when senior men can say a few words about safety on social occasions connected with the concern, at meetings of management and technical staff, joint works councils, etc. Presidents and chairmen of well-known
concerns frequently give opening addresses at big safety meetings of professional managers organised by safety societies or manufacturers' associations and governments. Such occasions do not create themselves spontaneously; these men's time is well occupied. Life safety organisation must provide the inspiration, the occasion and the planned arrangements.

At large-scale safety conferences of this kind, lecturers of an academic or semi-academic character find their place. The subjects may range from somewhat abstract aspects of psychology, precautions in using ionising radiations, the physiological aspects of noise, the classification of chemical products from the points of view of health and hazard, processes of safety in repetitive processes, to demonstrations in handling weights and descriptions of successful safety organisations. They are directed to managers, supervisors and professional safety personnel. The large attendances are evidence of the desire to keep abreast of current practice. Most well established conferences of this kind, now held at regular intervals began in very modest fashion with a small number of delegates. They would make a valuable contribution to the rapid appreciation of safe practices where industries are beginning to develop.

Where Lectures should be Avoided

Apart from the kind of conference indicated above, lectures in the professorial manner should be avoided in all cases where the intention is to convey information to, or arouse interest among personnel of all grades in a works or a group of works, where safe practices are concerned. As far as managers, supervisors and foremen are concerned some of the audio-visual aids noted in this report should be brought into use together with full use of discussions, including splitting up into small groups for special discussions. One of the underlying principles of training for safe practices in the case of officials of these ranks is that it should be designed as far as possible to serve as a break from day-to-day duties as well as providing information of professional value. Serious as the subject may be, it is better to avoid trying to cram too much solid - and indigestible - material into a session. The impression is given that the concern is adding to the burdens of officials instead of providing facilities which should make their tasks easier.

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1 See, as examples, reports from the Rome, Brussels and Paris world congresses on accident precautions; the Department of Labor, U.S.A.; The Ministry of Labour, United Kingdom; l'Institut National de Sécurité, France; l'Association des Industriels de Belgique, Brussels; The Association of British Chemical Manufacturers, London; The National Safety Council, U.S.A.; and from the Royal Society for the Prevention of Accidents, London, U.K.
Lecture Notes

Lecture notes should, generally, not be required except when a comparatively small number are in training for specific tasks, e.g., foremen, assistant foremen, young technicians who are being considered for junior management posts, safety officers or young managers who may be required for a time to act as safety officers as part of their training. Wherever possible, in training and conference sessions concerned with safe practices, the aim is not to equip the audience to pass examinations, nor to provide them with specific and infallible methods of achieving an object. The idea is to create personal interest in principles which can be considered by a participating audience and put into practice in their own special work.

If a lecturer uses notes on specific matters of detail, figures or references when dealing with some special aspect of safe practices, it is good practice to distribute copies to the audience, which should not be more than 20 in number. This avoids the distraction which is inevitable in note-writing and which may result in imperfect appreciation of the complete picture attempted by the speaker. Training, even in special subjects, should be made as easy as possible for the trainees.

Addressing Workers

As previously stated, exhortations in any form to workers should be avoided. Lectures to workers are included in this advice in most countries. A few minutes' talk on special occasions such as the showing of a safety film or a safety week or a special works campaign on a specific aspect of safe practices is as much as will have any positive effect. If any time is allocated, apart from these special occasions, to general safety meetings, they should preferably be limited in numbers of audience and appropriate use made of one of the audio-visual aids.

Printed Matter

Safety Handbooks

Safety handbooks can usefully be divided into two kinds in chemical industry.

The first type deals with the more common risks which may arise from unsafe practices in relation to the particular kind of factory, its chemicals, gas cylinders, special plant, fire risks, etc., as well as the general hazards such as falls of persons and materials, handling materials, unauthorised use of defective equipment or access to it, and as are to be met in any
kind of factory. They have been, and still are, much used where
the standards of literacy and/or industrial experience are low
and sometimes as adjuncts to safety weeks and special safety cam­
paigns. They attract most attention when profusely illustrated,
preferably with the aid of colour. Comic-strip technique is
frequently used, though, as in the case of newspaper comic-strips,
some of the subjects are by no means comic.

Included in this category are pamphlets, also of the comic-
strip type, issued to their member-firms by safety associations
for distribution to workers in special national industrial safety
campaigns. They have a large circulation and are evidently
popular, probably because a serious message is conveyed in a
humorous manner. Some examples are given in the illustrated
section of the present report.

A development of this type of handbook is a small one
intended for young workers and new employees. The contents
are, in effect, a short summary of the safety instruction courses
provided for these employees in some firms with sometimes a
simplified explanation of the works rules as they affect young
and new employees. It adds to the effect when the employee's
name is written in the handbook and if he signs a tear-off slip
acknowledging its receipt.

An example of the kind of text to be found in these handbooks
is given below.

"HOW TO PREVENT INJURIES WHILE
HANDLING MATERIALS.

"1. When lifting, always (a) get a good grip
of the article, (b) keep your back fairly straight
and your chin in, (c) slacken or bend your knees,
(d) take up a firm well balanced stance, lift
steadily and do not twist your body.

"2. If you consider the weight or size of the
article too difficult for you, ask for assistance.
When two or more people are handling objects together,
work as a team with one as leader.

"3. The above tips apply when lowering, pushing,
pulling or levering.

"4. Wear good, sound footwear with safety toecaps."
"5. Before taking hold of an article examine it and remove or avoid burrs, ragged or sharp edges, protruding nails, splinters, grease and oil, corrosive materials. Discard damaged equipment.

"6. Wear gloves or use other hand protection when handling glass, rough or sharp goods, hot or corrosive materials.

"7. When fitting or guiding pieces of equipment together watch out for nipping points.

"8. Report and have medical attention for all injuries; minor injuries to hands are frequent when handling materials - they should all receive first-aid at an ambulance station."

The translation of two pages from another handbook¹ is given below:

"Stacking of Materials

"Materials should be properly stacked so as to save space. Properly built stacks are stable.

Drums or any other cylindrical container liable to slide or roll should be stabilised or secured at the base.

Stacks should not be too high, so as not to overload the floor or endanger the stability of the row of stacks.

Leave plenty of room between stacks for the passage of people, bogie trucks and machines.

See that there are no dangerous protuberances from stacks.

In addition to using gloves to stack up drums or any other container used for acids, alkalis or other dangerous substances, always follow the safety instructions of your foreman."

Safety Manuals

A second and most important group of handbooks deal with specific specialised operations performed by workers who have been trained, or are undergoing training, for these particular tasks. In most instances in developed industries, the contents of these handbooks have the force of regulations in the works concerned. Some examples of titles which indicate the contents are -

The Rigger's Handbook
Standing Orders for Painting Gang
The Crane Driver's Rule Book
Rules for Shunters
Instructions for the erection of scaffolding and stages for maintenance purposes.
Instructions for the use of breathing apparatus.

It will be noted that the titles, which have been selected for this note on safety manuals indicate the thought and training which has been expanded on aspects of chemical industry apart from the operation of the many hundreds of distinctive chemical process operations. These are generally controlled by highly experienced technicians and foremen. In the operations covered by the safety manuals, the worker operates to some extent - and frequently to a great extent - on his own initiative. Close and constant supervision is usually impossible and the safety of the worker and the operation depends on -

Suitability for the job.
Efficiency of training.
Periodic checks by foremen of knowledge, efficiency and safe practices.

Types of jobs for which these manuals are most valuable are concerned with -

Maintenance and Repair.
Moving of plant for any purpose.
Transport in all forms.
The control of special apparatus, e.g. electricity.
The use of breathing and other apparatus provided for emergencies.
An aspect which is immediately appreciated by those with experience of the industry - but not always by the inexperienced - is that a large majority of workers in the industry are employed on jobs of this nature. In any variety of works it is common-sense that suitable people should be selected for this kind of work and that the foremen should be specially aware of their wide task. These factors are specially important in chemical works. In addition to ordinary factory risks there are usually inherent and hidden hazards which may evince themselves in startling and even fatal manner if mistakes are made or carelessness arises among these workers not engaged in the actual process. Moreover, as far as can be seen at the moment, there is little possibility of reducing these essential forms of work to automatic processes where the main task is simply to watch that the apparatus or machine continues to function.

Some extracts from a rigger's handbook make the point abundantly clear.

"1:1 DEFINITION OF A RIGGER

"A Rigger is a competent person who, by training and experience can move, lift and lower objects, by selecting, inspecting and using correctly, adequate registered equipment. He should be capable of estimating the weights of the objects he is called upon to handle.

"He is also a competent person to examine, select, obtain and erect material such as ladders, staging and scaffolding, needed to provide safe temporary access for himself, and in addition, when requested, to erect and maintain safe temporary access and safe temporary working platforms for other workers.

"A Rope Fitter is a Rigger, not necessarily experienced in staging work, who by training and experience is competent to prepare and splice ropes and to fit wire ropes to cranes, hoists, aerial ropeways and similar plant, and also to do general lifting work.

"A Rope Inspector is a Rigger who is a competent person to examine wire ropes and make a statutory report on their condition."
"Rope Inspectors and some Rope Fitters and Rope Greasers hold certificates of appointment, and only these persons are allowed to examine, fit, lubricate or adjust any rope, chain or attachment in connection with any crane, winch, grab, hoist, lift or other lifting appliance which is in motion and unguarded. Such work shall be done only when it is impossible to carry it out when the machine is shut down.

"1:2 TRAINING AND EXPERIENCE

"All men joining the Company's service as Riggers must satisfy the Foreman Rigger as to their competence and he will determine this by test and examination. Persons joining the Rigging Section without previous rigging experience will be given training and it is a rule of the Company that they shall pass the necessary tests within six months of joining the Section. These tests will include an examination by question and answer on the contents of this book together with practical tests on general rigging work.

"1:3 METHOD OF TRAINING

"The trainee will work with an experienced rigger under a Chargehand's supervision, until he has passed the test as mentioned in Section 1:2.

"1:4 REGISTERED EQUIPMENT

"The Tool and Lifting Gear Store is responsible for the registration and marking of every lifting appliance. Each lifting appliance is given a factory identification number and this number is quoted on all certificates and other documents referring to that appliance. Every lifting appliance has marked upon it the identification number and the safe working load. No unregistered lifting gear shall be used as rigging tackle under any circumstance.

"Wire lashings are not registered equipment and shall not be used for lifting or as a direct means of support for lifting or lowering a load."
"1 : 5 DEFINITION OF LIFTING APPLIANCES

"The term Lifting Appliance shall include Lifting Tackle and Lifting Machine. Items included in the following list will normally be considered Lifting Tackle:

- Boatswain's chair.
- Bordeaux connection.
- Bulldog grip.
- Chain.
- Eyebolt.
- Girder clip.
- Hook.
- Lifting beam.
- Lifting box or skip.
- Rigging screw.
- Rope.
- Turn buckle.
- Safety belt.
- Shackle, Link, Swivel.
- Sling including ring link and other component parts.
- Stretching screw.

The term Lifting Machine includes:

- Aerial cableways.
- Chain block.
- Any type of jack.
- Derrick pole.
- Any type of crane.
- Hoist and winch.
- Rope Block.
- Shear legs.

It will be seen that there is a good supply of "on-the-job" visual aids available, the trainer providing the "audio".

Additional information on these special aspects of safe practices in the industry can usually be obtained through the I.L.O. or direct from government chemical inspection departments or manufacturers' associations, as well as such societies as the National Safety Council, U.S.A.; l'Institut National de Sécurité, Paris and the Royal Society for the Prevention of Accidents, London.

Safety Codes and Regulations

Process operating instructions. The high standards of safe practices which exist in many chemical manufacturing organisations are largely the result of the discipline which these industries have voluntarily imposed upon themselves. A mass of evidence
of this attitude is to be seen in the safety codes, regulations, technical handbooks, hundreds of detailed operating instructions for chemical processes, data sheets and similar aids designed to make the tasks of technicians easier and more effective. Some of this material is not generally available. It is hardly to be expected, for instance, that detailed process instructions, will be made public property, though there is a recent public-spirited example by an American company.¹ In this case, part of a complex chemical manufacturing process is painstakingly analysed step by step under the headings: Jop Operational Element; Accident Hazard Potential; Safety Control. The technical details are not relevant to this report. What is particularly relevant is that this practice has been successfully followed for the last 16 years. Perfection seldom exists, and it can be assumed that unless periodic re-evaluations are made, some elements in the process may change. The analysis must be made by the first-line supervisor himself, with the individual operators concerned. "To suggest that somebody else should make the analysis would be the same as saying that somebody else should eat his dinner for him." There can be no clearer example in discussing safe practices in chemical industry of "real life" aids on the job.

Laboratories and semi-technical plants. Such manuals as are issued as instructions, regulations and aids for internal use in industrial laboratories and semi-technical plants frequently relate to special work and processes and, again, are not available publicly or for specific reference. Sufficient information of a general kind, however, can be had from the sections of this report which touch upon training in a laboratory. Where internal manuals exist they have been built up from bases such as those described. More specific information can sometimes be obtained through international connections, or through manufacturers' associations or personal contacts in the developed countries. The best way of appreciating tidiness, safe practices, efficiency and freedom from accidents is to visit recommended examples of industrial laboratories. No trade secrets will be revealed, but it will be seen that competent industrial arrangements compare favourably with those found in academic centres of learning and training.


² See also: "Safety in Chemical Laboratories", Manufacturing Chemists' Association, Washington, D.C.
Engineering Codes and Regulations

Engineering codes and regulations, if kept within reasonable limits of length and specification such as are used in several forms in the chemical industries, are powerful aids to designers drawing offices, constructors, engineers, industrial chemists and safety organisations. These codes and regulations have as their base national legislation but have been greatly developed outside those limits by the voluntary efforts of industrial concerns. In most respects these codes and regulations could be applied without much alteration to many heavy industries; it is simply a matter of history that the chemical industries took the original steps to improve safe practices in this way and that, up till now, it continues to develop this method and to make its engineering codes and regulations publicly available.

As far as this report is concerned only a brief reference could be made to the great amount of printed matter and legislation which have resulted in the codes and regulations now generally in force, in one form or another, in advanced chemical industry. The Model Code of Safety Regulations for Industrial Establishments for the Guidance of Governments and Industry\(^1\) includes, in effect, a practical summary of advice arising from the history of this subject in its engineering aspects. There are a few places of work where some improvements could not be effected by a re-reading of this Code. In developing countries, the Code provides a most convenient guide for comparison, adaptation and action suited to local circumstances, especially in relation to legislation. There are many instances where industrial legislation, if it is to serve the best purpose, can be abstracted selectively, and arranged in an order convenient for a particular industry - in brief, codified. There is an equal need for codifying the best professional practices of engineers - civil, mechanical and electrical, as well as the specialist engineers and technicians in the new fields of atomic energy, electronics and the like - also in relation to particular industries - in highly summarised form. Both as regards legislation and professional practice, in this context of application to a particular industry, the aim is not to produce bulky text books for students, but brief and logically arranged reminders for practising and practical engineers and their colleagues.

As they are usually produced for internal use in industries, complete sets of such codes and regulations are not generally available for reference. Their existence is, however, known to government labour inspectorates, the large national voluntary safety organisations, chemical manufacturers' associations, societies of safety engineers, etc.

\(^1\) I.L.O., Geneva, 1954.
One such set of codes and regulations which operate in a large chemical firm has been made generally available, though some sections are out of print. The sections are:

**Civil Engineering**
- Sites and Services
- Buildings and Construction (Design)
- Construction and Maintenance
- Railways and Haulages (Design)
- Railways and Haulages (Operation)
- Road Transport of Engineering Plant and Material
- Docks, Wharves and Quays.

**Mechanical Engineering**
- Design, Layout and Installation of Machines
- Construction and Maintenance
- Lifting Appliances
- The Periodic Examination, Testing and Registration of Pressure Vessels.

**Electrical Engineering**
- Statutory and other Rules, Regulations and Codes
- Plant Installations
- Portable and Transportable Plant and Equipment.

**Miscellaneous**
- Fire Prevention.

**Safety Rules, Information and Data Sheets**

Some manufacturers' associations have produced, and are still producing, aids of the highest value. Notable are the Manufacturing Chemists' Association, Washington and the Association of British Chemical Manufacturers, London. Both these associations, within reasonable limits of numbers of applications, generally made their safety publications available to the industry as a whole.

Two aspects of special interest are "Model rules for use in chemical works" issued by the Association of British Chemical Manufacturers and the chemical safety data sheets of the Manufacturing Chemists' Association. The model rules provide a succinct guide to the necessary disciplinary and technical measures, and rules for the design, construction, operation and maintenance of plants with risks from fire, explosion, gas, vapour, fume, dust, corrosive substances, etc.

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The chemical safety data sheets of the Manufacturing Chemists' Association give the essential information for the safe handling and use of a large number of chemicals. They set the highest standard in these aspects and have a reputation and use in many countries.

The advanced manufacturers' associations have safety information services in various forms for their members, usually involving the voluntary work of members or the staff of members who serve on the technical safety committees, as well as the specific safety work and research done by the staffs of the associations.

They are also responsible for many of the safety abstracts and summaries published either directly for their members or made available through the technical press.

**Safety Periodical Publications**

In general, these are not designed for issue to the workers, though there are exceptions. The British Iron and Steel Federation, for example, has issued an illustrated safety magazine of the highest professional standard as part of the safety organisation in that industry. Mostly, however, they fall under the following heads:

- National Safety Magazines addressed to managers, technicians, supervisors and safety officers;
- Technical and semi-technical periodical publications issued by specialist safety associations, manufacturers' associations and government authorities;
- Periodical publications issued privately for internal use by managements and supervisors in large concerns.

Information on all these publications is usually available from government labour inspection departments and the voluntary safety organisations in different countries.

**Special Safety Events in Works**

Special events which are frankly directed to increasing and maintaining the interest of the works in ordinary day-to-day safe practices are a feature of the safety organisations in many works. They can be confidently recommended where all the personnel are aware of the management's policy to secure safe practices and to prevent accidents and can see actual evidence of this for themselves.
Competitions

Different forms of competitions make a good beginning to a long distance programme of special events.

**Accident rate competitions.** The simplest is an accident rate competition between departments (in large concerns between works or groups of works). The winners may either (a) have achieved the best accident rate over a period or (b) have made the biggest percentage improvement over their previous best rate. The form of reward must suit the circumstances and the country concerned, having in mind that worthwhile prizes to each of the individual members of a department or a works cost sums of money which might be better spent on an aspect of safety of more general benefit. Further, once such a scheme has been started, it is difficult to stop it. Individual prizes are probably better given in other forms of competitions described below. Recommended rewards are -

(a) a prominent notice on the large board such as

**Accident Record Competition**

Winning Department: INTERMEDIATES XY

October 1965

Improvement on previous best: 9.2 per cent.

(b) the same as (a) with a large flag or other challenge trophy;

(c) a tea or coffee party or a dinner for longer periods, say six months; (this gives an opportunity for a senior manager to make a speech, but it must be brief);

(d) a sum of money to the department's social or similar committee for a social occasion, children's party, a special welfare activity, etc.

Over a long period (a) and (b) are probably best. Any money granted by the firm is generally spent more effectively on special events such as safety weeks.
Tidiness competitions. The next form of competition recommended is concerned with works tidiness, with independent judges who may inspect either with or without previous notice. The judges must be thoroughly familiar with works conditions, as some departments may operate old processes in old buildings where complete cleanliness is impossible. Tidiness in such a case is relative, not absolute, and the verdict calls for experience and impartial judgment. It is not unusual to find that chemical works up to 100 years old have reached astonishingly high standards of cleanliness and tidiness. Prizes should be as in (a) or (b) above with a social gathering at intervals as in (c) for sections with long continued good records.

Special Campaigns

Special campaigns are recommended as the next for consideration in the long-term safety programme. They may continue for periods of a week to a month and are concerned with specific subjects, e.g. fire, electricity, hand tools, handling goods and packages. Where the campaign for safe practices is still in the relatively early stages of development, special drives can be made on obtaining and using the correct equipment and returning to store when found defective. This latter often requires much pressure, persuasion and propaganda; ladders, scaffolding, staging, temporary arrangements for access to heights, ropes, chains, lifting gear and protective clothing are examples. The system of storage, examination and issue may be perfect in theory but the final test is in the hands of the user.

For special campaigns one firm with a remarkable record of low accident rates appoints an organising committee with the senior technical man concerned, one or two younger managers, the foreman concerned, one or two workers and the safety officer, who acts as secretary.

One such campaign wisely dealt with electrical hazards, in spite of the fact that there had been no electrical accident in the works for ten years. Everyone knows, or should know, that electrical accidents in good chemical works are rare, but when they do occur they are frequently fatal. There is a serious danger of familiarity and freedom from accident breeding contempt and a special effort, even at long intervals, is well worthwhile.

These special campaigns need careful thought, examination of the experience of others, long preparation, the active cooperation of many members of the personnel, together with boldness and ingenuity in presentation. In one case, the campaign included the following:
Aims

The committee adopted the following aims for the programme.

1. To employ publicity calculated to shock and break down possible complacency.
2. To show that low voltages can be lethal.
3. To outline safe procedures for operation, maintenance and design of electrical apparatus.
4. To instruct in electrical first-aid.
5. To improve electrical first-aid.
6. To survey existing plant conditions and eliminate electrical hazards.
7. To prevent interference with electrical equipment by untrained employees.

Programme Summary

1. General Publicity

   The programme was announced in a personal letter to each employee's home.

2. The letter was accompanied by an outline of the programme and details of the various competitions.

3. An illuminated display at the main works entrance was erected, designed and painted by the staff.

4. A poster campaign with frequent changes was organised throughout the month.

Demonstration Centre

An old workshop was converted.

The exhibits gave an indication of the demonstrations, which included electrical faults, bad practices, good installation practice and several working exhibits. Electrical safety in the home was also featured. A visitors' book was signed by nearly 700 people.
Competitions

Slogan and electrical suggestions competitions with small prizes were held.

Safety Talks

Short talks to staff and shop floor talks by foremen dealt with electrical hazards. A senior government inspector gave a talk (for which he is renowned) illustrated by exhibits and working models to a crowded audience.

Hazard Survey

Members of the organising committee inspected the works in sections. Perforated labels were fixed to electrical hazards, the list given to the plant supervisor, one-half of the label being returned to the safety officer when the fault was remedied. There were a surprising number of such faults in this admittedly excellent works.

Films

An electrical safety film was shown.

Over-all Comment

A cross section of about 10 per cent. of the personnel were interviewed, with the following results:

1. Effectiveness of home mailing -
   Yes, 83 per cent.
   No, 17 per cent.

2. Interesting competition -
   Slogans, 32 per cent.
   Suggestions, 17 per cent.
   Acrostic, 23 per cent.
   No interest, 28 per cent.

Effectiveness of safety talks
   Yes, 70 per cent. No, 30 per cent.

Visits to demonstration centre
   Yes, 77 per cent. No, 23 per cent.
Helpfulness of demonstration centre
Yes, 96 per cent. No, 4 per cent.

Most effective feature of campaign

<table>
<thead>
<tr>
<th>Feature</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home mailing</td>
<td>8 per cent.</td>
</tr>
<tr>
<td>Competitions</td>
<td>7 per cent.</td>
</tr>
<tr>
<td>Demonstration Centre</td>
<td>28 per cent.</td>
</tr>
<tr>
<td>Safety talks</td>
<td>32 per cent.</td>
</tr>
<tr>
<td>Hazard survey</td>
<td>25 per cent.</td>
</tr>
</tbody>
</table>

From which it can be seen that the organisers provided features of interest to most sections of the employees. The direct costs were under £250.

Safety Weeks

Safety weeks are conducted on the same lines and with the same kind of organisation as special campaigns. They are concerned with safety aspects as a whole rather than any particular hazard or potential hazard. The same careful and sometimes lengthy preparation is necessary by a small powerful committee, supported by the management. Though sometimes more difficult than in the case of special campaigns, the organising committee should list its main aims for the week and devise its programme accordingly with the co-operation of the supervisory specialists concerned, the works safety committee (who should be given some active function), the works council and any other works organisation which might be helpful.

The programme will obviously concern itself with those accidents which cause lost-time or visits to the first-aid centre but other hazards which may have caused no injury for years should be kept in mind, as was shown, for instance, in the electrical campaign described above.

The "competition" aspect is possibly best achieved by some system of drawing for small prizes. For example, the printed copies of the letter of the manager or, preferably the organising or safety committee, are numbered and a prize or prizes awarded daily. One result is that each recipient of the letter usually

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1 See illustrations in this report.
retains it for the week. Additional interest can be provided, e.g. a winner wearing his safety boots has his prize doubled, or, if he can repeat the day's works slogan (a different one posted each day) received an extra award — and so on.

Variations of all the items in the special campaign quoted above can be used and special use, such as the incorporation of moving or illuminated figures, charts and photographs, made of safety notice boards, especially the large board at the point of vantage.

Exhibitions

The exhibition technique familiar in trade fairs has become a useful aid to safe practices. Large — sometimes very large — safety trade exhibitions are held in connection with national and international conferences. The main object is to sell safety apparatus, but organised works visits to such exhibitions are of considerable interest to workers: a visit of this kind would be a suitable prize in a works safety competition. In 1929, the International Labour Conference recommended to all its States Members the establishment or promotion of permanent safety exhibitions.¹ The exhibitions with which this report is concerned are, however, those organised by industrial concerns for their own works. The illustrated section shows some examples. The following are brief general points:

1. Temporary exhibitions associated with special safety campaigns or safety weeks are the most used.

2. In large firms, and sometimes in a chemical industry, safety exhibitions are designed and built centrally and arranged so as to be transportable. Such exhibitions may either deal comprehensively with all safety matters, or may be confined to a limited aspect of safety. The works where the exhibition is used add local material. This is usually considered important.

3. Permanent safety exhibitions are not recommended for works but a good arrangement is to have a place, such as a large show case or a special room, devoted to safety exhibits which are changed at intervals. The lecture or training room in the works is good for this purpose.

4. Skilled professional advice is desirable.

5. If this is not available, exhibitions similar to that under consideration should be studied personally. In this way, the various fixing and lighting devices, colour schemes, different forms of display boards and stands, spacing arrangements and, particularly, methods of achieving a reasonable degree of economy without spoiling the effect can be studied. Exhibitions can, without these precautions, prove costly. Equally, they can fail to grip interest because they look cheap, because of lack of skill or experience and not because too little money has been spent.

6. If neither professional skill nor some experience as in 5 above is possible, good original working ideas can be obtained from photographs and illustrations. Also, some appreciation of the technique and equipment required could probably be obtained by writing to well-known voluntary safety societies in certain countries. Difficulties may arise from lack of suitable exhibits and, if these are insuperable, it is difficult to see how a successful exhibition could be organised without practical assistance from outside sources. The effort would probably be better spent on some of the other devices mentioned in this report.

The way for exhibitions in works must be well prepared by suitable forms of publicity, general backing by works managements and committees and special consultations and co-operation from the kind of organising committee mentioned above. The impression that this is somebody's special hobby should not be allowed to exist; it is a joint works effort.

Effective use of exhibitions in works can only be had when employees are given time off to visit them. They will not attend in any numbers before or after work or at meal times.

Questionnaires as to the effectiveness of the exhibition, or parts of it, are interesting and may add to the attention drawn to the subject. For the practical technical purposes of deciding what makes, or does not make, a good exhibit, they are of no great value unless there is an overwhelming vote against a specific type of exhibit and that very rarely happens. The organisers themselves, with a competent leader, must devise their own attractions, based on the fact that they have the real knowledge of the matters to which the exhibition should draw attention.
Fig. 1
Instruct new workers on safety rules
Initier le nouvel embauché aux règles de sécurité

Fig. 2
Overhead projection of pictures
Les projecteurs périscopiques des images
Handling of drums

Manutention des tonneaux

Fig. 3

Fig. 4

Fig. 5

Fig. 6
Handling of drums (continued)
Manutention des tonneaux (suite)

Fig. 7

Fig. 8

Fig. 9

Fig. 10
11. Lay the drum on its side. Pierce the side near one end, preferably on the longitudinal seam and cut right along to the other end of the drum with the chisel-shaped end of a 5-6 ft. crowbar. Insert the end of the crowbar into the slit.

12. Insert another similar crowbar under the opposite side of the slit so that the two crowbars form a cross. Push the crowbars at right angles to the length of the drum so that the sheet of metal which forms the sides of the drum is opened out.

13. Exchange crowbars and continue to open out until the sides of the drum are stripped away from the contents.

14. The contents of the drum can then be rolled out whole.

11. Coucher le tonneau. Percer le flanc près d'une extrémité, de préférence sur le joint longitudinal, et couper tout droit jusqu'à l'autre extrémité du tonneau avec le bout biseauté d'une barre de 1,5-1,8 m. Insérer le bout de la barre dans la fente.

12. Insérer une autre barre similaire dans la fente de façon que les deux barres forment une croix. Enfoncer les barres à angle droit par rapport à l'axe longitudinal du tonneau de manière à ouvrir la tôle qui forme les côtés du tonneau.

13. Echanger les barres et continuer à déployer la tôle jusqu'à ce qu'elle soit détachée du contenu.

14. Le contenu du tonneau peut alors être sorti en un seul bloc.

PERSONNEL ENGAGED IN THESE OPERATIONS MUST WEAR GOGGLES

LE PERSONNEL AFFECTE A CES OPERATIONS DOIT PORTER DES LUNETTES PROTECTRICES
DANGER SYMBOLS
EMBLÈMES DE DANGER
SÍMBOLOS DE PELIGRO

Fig. 15
Danger of explosion
Danger d'explosion
Peligro de explosión

Fig. 16
Danger of poisoning
Danger d'intoxication
Peligro de intoxicación

Fig. 17
Danger of ignition
Danger d'inflammation
Peligro de inflamación

Fig. 18
Oxidising agent
Matière comburante
Substancia comburente

Fig. 19
Danger of corrosion
Danger de corrosion
Peligro de corrosión

Fig. 20
Dangerous radiations
Radiations dangereuses
Radiaciones peligrosas
Good lighting
Bon éclairage

Deficient lighting, difficulties in the lighting of machinery resulting in sharp contrast of light and dark produce eye fatigue, tiredness and accidents, adversely affecting production.

Un éclairage insuffisant, une machine difficile à éclairer donnant lieu à des contrastes excessifs sont une cause de fatigue, particulièrement pour la vue et risquent de provoquer des accidents, tout en diminuant la production.

An adequate and even lighting free from dark areas allows better working conditions, reducing accident risks and increasing production.

Avec un éclairage adéquat et uniforme et sans contraste, on voit et on travaille mieux, les risques d'accidents diminuent et on augmente la production.
How to lift heavy loads
Comment soulever des charges lourdes

Fig. 23

Fig. 24

Fig. 25

Fig. 26

Fig. 27
Fig. 28

Properly clothed to handle carboys
Un bon équipement pour la manutention des bonbonnes

Fig. 29

Breathing protection
Protection des organes respiratoires

Fig. 30

Use special bottles for dangerous liquids
Mets les produits dangereux dans des flacons spéciaux
Fig. 31

Look out! Avoid accidents
Attention, évite les accidents

Fig. 32

Check all chains
Vérifie les chaînes

Fig. 33

Overhanging loads are dangerous!
Au-dessous des charges suspendues la mort te guette
Fig. 34

Danger
Danger de mort

Fig. 35

Dangerous
Safe
Ainsi, c’est correct

Fig. 36

Use a voltage detector
Utilise un détecteur de tension

Fig. 37

Water, gas and steam pipes are electric conductors
Les canalisations d’eau, de gaz et de vapeur sont aussi de bons conducteurs
Travelling exhibition
Exposition itinérante
La minute de sécurité.
Aide à la prévention des accidents :
Pense une minute à la sécurité;
vois où est le danger et réagis !

Prévention des accidents
Concours de sécurité entre les ateliers
CHAPTER III

ORGANISATION FOR SAFE PRACTICES

General Approach

Top management's part in the achievement of safe practices is to examine proved principles, to determine major policy, to include safe working as an integral part of production and to check results at intervals. These are the essentials, and they are not excessively time consuming after the necessary managerial action has been taken.

The executive action is, naturally, delegated to an individual directly responsible to the active directorate (in large concerns he is one of them) or to the works manager. Success or failure then depends largely on the advisory safety organisation, whether it consists of a part-time safety officer and trainer in a small firm, or whether it grows up to a staff of several persons in large ones.

This report now deals with matters of detail - important detail - which are the concern of the safety organisations in the industry, after they have, with the support of their managements, worked on the early stages of their programmes.

Securing Co-operation

Obviously, the safety organisation in any concern cannot by its own direct efforts secure safe practices, neither can it undertake the whole of the training. Equally, it is undesirable that it should attempt to do so. The safety organisation's task is to secure the willing co-operation of those who actually manage, design and construct the plants and of those who actually work in those plants.

It has already been stated that the foreman is the key-man, and that an essential feature of organisation and training - of which safety training is part - should be consciously aimed at making the foreman's task easier and more efficient. It has also been stated that exhortations addressed to the workers will not achieve safe practices. The same is true in relation to foremen, who will naturally require to be convinced, by evidence, that their efforts are supported by the professional approach and example of those in higher supervisory grades.

In the programme for achieving safe practices the safety organisation, or whatever equivalent may be used, has, therefore, a very wide field of contact, training, persuasion and reminder. In its complete form, which takes time to reach, all ranks are
drawn within the orbit, either making some personal contribution
to safety or receiving training or both. At the highest level,
for instance, a brief reference to works safety in the company
appears in the chairman’s annual report to the shareholders.
Whether or not the shareholders are interested, the personnel
certainly is in this indication of the value placed on safety
in the company. A safety organisation which has established
this level of contact can claim to have achieved status and
prestige, and to have acquired an audio-visual aid of the
greatest value. This is even more evident when the chairman’s
annual report is made available to all workers, as now often
happens.

Meetings for Senior Managers

However, persons who have reached the status of directors
and senior executive managers are not subjects for training;
they prescribe policies and set standards of performance, partly
from knowledge acquired in their own careers and partly on the
advice of their staffs. At the same time, busy senior managers
rarely have opportunities of leisurely contact with equally senior
managers from other works. Occasions can profitably be created
and have been inspired from below these high ranks. One good
plan is for a day or one-and-a-half days to be set aside—
perhaps only at intervals of two or three years. A typical
programme would include some introductions to discussion on
safety problems, a works visit and a social dinner. A sample pro­
gramme is given in Chapter IV of the present report. A small
exhibition of visual aids and a short film, if they are good and
original, are matters of real interest. Large concerns with
several factories organise such conferences themselves and they
gain from the intimate and informal exchange of views. Similar
meetings are organised centrally by the agencies already
mentioned and the tone is set by an opening address by, for
example, the chairman of a well known company with a good accident
record. Here again, examples of good visual aids will attract
close attention.

Examples of Meetings and Conferences

Remembering that the junior supervisor and technician of
today is potentially the top man of tomorrow, the safety
organisation will take all opportunities of participating in
the training, conferences and meetings which are arranged for
different grades and professions. Given a proper opportunity
and some guidance, these younger managers will take a pride in
encouraging safe practices in their own spheres and the use of
visual aids, such as described in this report, will enable them
in many instances to employ similar devices in training their
own personnel. Examples from conferences, training courses, etc.,
for managers, technicians and supervisors are given in Chapter IV. Some of the supervisory ranks in chemical industries who have been concerned are:

1. Senior managers, assistant works managers and works engineers
2. Plant (large section of works) managers, maintenance managers
3. Research staffs responsible for large laboratories, research departments and semi-technical development plants.
4. Younger technical staffs, section heads and other supervisors with university education or equivalent.

The numbers of members of each course should preferably not exceed 20. The professorial attitude of lecturing should be avoided and the members not expected to take notes, but to express and exchange opinions between themselves and the lecturer. A well proved idea is to split up into "syndicates" of five for case studies. A common error is to allow too little time for the final reports by the "syndicate" leaders. Personnel of the calibre attending such courses will be impressed by visual aids to the extent that they can use them or influence their use, in the instruction of those in their charge. A good sample exhibition of aids makes a useful meeting place in the intervals. The International Labour Conference recommended in 1947\(^1\) the use of safety exhibitions as means of instruction. The film strip for case studies is valuable in this type of course, as well as method studies using the standard symbols and extracts from job instruction cards. The law relating to safety is very important in some countries and will eventually become so in many others. It can be explained in an attractive manner by an experienced talker and people of these ranks are usually keenly interested. There are some good films illustrating legal requirements, but naturally these are of first interest in the countries of origin. There would be much value in the making of short films and film strips illustrating safe practices based on legal requirements or on principles used in other countries. But it is probably worse than useless to make blind use of foreign films depicting characters blatantly different from the audience.


\[^2\] See note on films, etc., in Chapter II of the present report.
Foremen, Assistant Foremen and Charge-hands

The foreman is responsible for the safety of those in his charge and he needs much help and specific training if he is to fulfil that responsibility. The modern tendency is, wisely, to raise the status of the foreman in chemical industry, but that is not done by the stroke of a pen or the issue of an order. In the opening chapter, which puts a case for the consideration of higher managements, it is indicated that adequate training for foremen demands, in effect, a difficult and highly concentrated educational course. There are some aspects which are obvious. The foreman or trainee-foreman usually has not had the educational advantages of the professional staff. It is probably best, therefore, though not always possible, to concentrate on the younger men as an investment for the future, if a choice has to be made. Safety training as a separate subject is in a different category and there is a good case for providing this for all foremen, their assistants and charge-hands.

Extracts from such courses are grouped in Chapter IV. It will be clear that many of the kinds of visual aids described in Chapter II can be used in foremen's safety courses and also that some of the aids can be valuable when later used by foremen in talking to their men. Periodic "foremen's talks" or "shop floor talks" are features of many safety programmes. However, it should be borne in mind that most foremen are men of action rather than men of speech. The safety organisation should be ready to provide written "talks" and "Safety-graphs". Examples are given in Chapter II. Use can be made of foremen's associations where opportunity can be taken for informal discussions on special problems of foremanship, including safe practices. Private conversations, where the foreman can express his ideas freely to his manager, are possibly the most valuable of all aids; the safety organisation can use its influence to encourage such exchanges of views.

Teaching Safe Practices to Workers

The safety organisation's share in the direct teaching of safe practices to workers is limited to (a) induction courses for new and young workers and (b) training courses for apprentices and other young workers whom it is desired to train off the job. The greater part of other direct training of workers is the task of the foremen who have them in their charge. Any other system interferes with the line of command and destroys much of the foreman's authority and prestige. It is both inhuman and inefficient to pitch-fork young workers into industry without making a very serious attempt to introduce them to the new conditions and completely different circumstances of their lives when at work.
Induction and Training

"At the beginning of their employment all young workers should be instructed in safe working practices and warned against behaviour which may lead to danger and injury. They should be taught to be safety conscious, and taught the danger of such things as loose clothing which may get entangled in machines, and of shoes that give inadequate protection to the feet. Induction and training should aim at helping young recruits to adjust themselves to their industrial environment. Training schemes should include the following points:

(1) The young worker should be taken round those parts of the factory where he will work and should be shown what the principal dangers are, how they arise and how to avoid them.

(2) A fully competent adult worker should directly supervise the young person's work during the initial period of training.

(3) The proper method of working any machine on which the youngster is to be employed should be illustrated in detail and the dangers associated with other undesirable methods explained.

(4) Departmental managers and other supervisory grades should be given clear instructions on accident prevention and on the need for keeping close control over the work of the young persons under their charge.

(5) Strict discipline should be enforced in the adoption of safe methods.

(6) Special safety propaganda - talks, lectures, films, safety codes, accident charts, for example - should hammer home the important points and make young workers aware of the importance which is attached by the employer, and in all supervisory positions, to the principles of accident prevention.

Many firms are able to run special training courses for youngsters or have an apprenticeship scheme in which provision is made for regular instruction on accident prevention. Such firms quickly realise how effectively this training can help to reduce the number of accidents and, incidentally, by this means save themselves a considerable amount of money. But it is not only firms with large numbers of youngsters and great financial resources that can achieve such results. It is
well within the capacity of managers and supervisory staffs in smaller firms to make the effort to see that their young recruits have a good and safe start in their chosen career."

An example of an induction course in the chemical industry is given in Chapter IV. The many opportunities of using practical visual-aids associated with the work will be seen.

**Safety on the Job**

**Additional Aids to Safe Practices**

Those with long experience of the chemical industries will agree that there is no works, however advanced, in which perfect safe practices exist all the time. Apart from changes in process or layout, there is always a need for constant watchfulness by the management and the safety organisation. There is an even greater need for definite steps to be taken, not only to exercise a continuous check but to make it plain that safety ranks high in the works and that the co-operation of everyone is desired.

Another part of the safety organisation's busy task is therefore to inspire a constant flow of schemes to bring the management's policy, aims and interest in safe practices as closely as possible to the notice of those engaged in the productive work of the factory. To bring this about, extra effort has to be made in the actual place of work. This is another aspect which demonstrates the need for a safety officer who has status and who understands the art of suggestion and organisation without interfering with the line of command. Most of the suggestions will originate from him, and much of the work of giving practical effect to the ideas will fall upon him. Some examples are given below.

**The Manager's Safety Visit**

A walk round the works, or part of the works, by the senior manager or his assistant with the one idea of safety in mind. There are cases where men of this rank are rarely seen on the works and then, usually, when there is some technical trouble with the process. A talk with department heads and foremen is a potent factor in keeping high standards. Top managers are always busy men, but the really busy man can make time for this essential work.

**Tours by Safety Committees**

These are useful if led by an experienced official. Not only do they help to improve safe practices through the fact that they are visiting a department but they gain experience

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which should be useful in raising standards of practical dis-
cussion at their regular meetings. It is much to be desired
that their observations should first be discussed with the
foreman of the department before committee meetings. This
avoids the danger of interfering with the line of command and
should secure the active co-operation of the foreman. However,
tours by safety committees sometimes degenerate into mere
routine. Other methods are necessary and it may be advisable
for safety committee inspections to be suspended for a time.

Job Safety Reviews

These take place in a number of concerns. They vary from
highly technical evaluations of new and changed processes or re-
evaluations of existing processes1 to relatively elementary —
but equally essential — surveys of parts of processes, main-
tenance and general work in which a danger has been perceived
or the standard of safety allowed to deteriorate. One good
scheme is to select small mixed teams for specific reviews, e.g.:

(i) Process manager or engineer,
    Foreman,
    Plant representative of works committee,
    Process workers or tradesmen.

(ii) Foreman,
    Charge-hand,
    Safety committee representative,
    Operator.

(iii) Foreman or charge-hand,
     Committee representative,
     Shop-steward,
     Two operators familiar with the work.

(iv) Laboratory supervisor,
     Two laboratory assistants.

The inclusion of a member from another department should
help to secure an unbiased opinion. Here again, every effort
must be made to secure the willing co-operation of the foreman.

1 For an excellent example, see Stanley F. Spence: "Re-evaluating Existing Processes" (American Chemical Society, 1960).
Example (1): Manual Handling of Sheets to and from Cutting Table

Hazards observed

(a) Operator wearing canvas slipper shoes.
(b) Alleged ambiguity of instructions on the wearing of protective gloves. Panel recommends fingerless gloves.
(c) Floor area markings had faded and were not observed. Congestion resulted.
(d) Transfer of sheet from "A" frame bogie to cutting table is awkward and a potential cause of muscular strain.

Action

(a) Supervisors to be informed that they should see that suitable footwear is worn.
(b) Establish that there is no ambiguity in instructions on wearing gloves. Full gloves to be worn, contrary to panel recommendation.
(c) Renew floor area markings and maintain them.
(d) (i) Consider alterations in design of receiving and of cutting table.
(ii) Consider application of kinetic handling principles to do this job.

Example (2): Test of a Chemical in a Process

Hazards and Defects Observed

(a) Sampling point exposed to high winds with consequent risk of splashing.
(b) Container beneath sampling point unsatisfactory.
(c) Sampling valve and discharge point too large, so that it is impossible to avoid spraying the outside of the bottle when taking a sample.
(d) Sample bottle not correctly labelled, and not washed after sampling.
(e) Top for the Atomixer no longer satisfactory.
(f) Top on the caustic soda aspirator defective.
(g) The laid down method of test was not being strictly followed in that:
   (i) Watch glasses were not being used during weighing operation.
   (ii) The pipette used for taking a portion of the sample was laid on the bench between weighings, thus transferring some formalin to the bench.
   (iii) Neutralisation not being carried out in identical flasks.
   (iv) Burette used for the test had a chipped top.

Action

(a) Alter position of sampling point.
(b) Make suitable arrangements for emptying container.
(c) Modify sample valve and discharge tube, and shield the tube.
(d) Ensure correct labelling of bottles.
(e) New tops for Atomixer.
(f) Replace tap on caustic aspirator and search for better grease to prevent encrustation of caustic round tap.
(g) Attention by supervisor to ensure correct method of work.

A development of this scheme, which is strongly recommended after a reasonable standard of safe practices has been obtained, is to use the same principle in relation to all operations in the works. This may take a year or two but is a constant reminder to all the personnel. It is par excellence an audio-visual aid.
A Check List for Job Safety

Another way of evaluating safe practices is indicated in the check list for job safety used in "Training within industry" methods. Extracts are given below.

1. The Work Area

   SPOT the danger in:
   Storage and stacking
   Passages and exits
   Moving objects
   Surfaces and edges
   Lack of order and cleanliness
   Defective heating, lighting and ventilation.

   INSPECT for unsafe conditions in:
   Floor, roof and walls
   Firmness of fixtures
   Access to fire appliances.

2. The Work Method

   SPOT the danger in:
   Poor maintenance
   Defective tools and materials
   Poor or untidy layout
   Handling materials
   Defective safety guards
   Deficiencies in other protective equipment.

3. The Worker

   Check on knowledge of safety rules.

   SPOT the danger in:
   Personal attire
   General conduct
   Use of protective devices and clothing
   Method of doing work.

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Works Safety Committees

A management which grasps the fact that democracy and joint co-operation are now inherent in industry will initiate and support a works safety committee. They are valuable aids to good industrial relations as well as to safety. If they are begun without careful thought, including a keen appreciation of local conditions, embarrassing results may ensue. Careful thought includes some measures already taken by managements to improve safe practices. The establishment of a safety committee can only follow this preliminary work. Otherwise, the management will receive, as the only result of the committee's formation, an unending stream of complaints and suggestions which is too great for early remedy and action.

In its early stage, a works safety committee usually presents many suggestions to the management and it must be made clear that, as reasonable people, the workers' representatives will realise that time is needed to deal with them. The management will avoid disappointment and risk of failure by stating plainly what it intends to do in respect of each suggestion - including its decisions to make no change in the appropriate instances.

Information and advice can be had from central organisations.

In summary, the chairman is usually chosen as a senior member of the factory management, of strong but sympathetic character. Managers and foremen should be included and at least half the committee should be elected representatives of the workers. The secretary is ex-officio, usually the safety officer. Small committees are best, 16 members being the maximum recommended. If appropriate the committee can be departmental. The committee should be advisory. It should meet at regular intervals, preferably monthly. Most meetings are now held in the firm's time. Typical rules are:

"1. The duties of the Committee shall be to stimulate the interest of all employees in the prevention of accidents and to assist the management with suggestions.

2. The Committee shall enquire into the circumstances of all accidents in the factory which shall be brought to their notice and for this purpose: (a) the

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Company shall notify the Committee through its Secretary of all reported accidents; (b) the Committee shall appoint an accident investigation Sub-Committee of three with the power to co-opt, which shall make full inquiry into any accident referred to it and issue a report thereon to the Safety Committee. The members of this Sub-Committee shall be permanently appointed during their term of office on the Safety Committee (or 'shall be appointed by rota from the main Committee'); (c) the Committee, when they consider it desirable, shall publish an account of any accident investigated, the causes which led to it and the result of the investigation with possible means to prevent recurrence.

3. Each departmental representative shall be responsible for reporting defects and dangerous practices within his department to the Committee after drawing the attention of his foreman (and/or departmental manager) to the matter.

4. The Committee shall cause a report to be made by the Safety Officer at each meeting and, after consideration and amendment if necessary, shall forward the report to the management (add if necessary 'and to the Works or Foremen's Committee') with their recommendations.

The report should include, among other matters:

(a) Accident return since date of last meeting.
(b) Safety devices installed and instructions issued.
(c) Steps taken to prevent recurrence of accidents
(d) Return of attendances at ambulance stations with any remarks thereon.
(e) Return of suggestions dealt with."

It is the general experience that after these joint committees have settled down to their work they are most valuable aids to safe practices. It should, however, be re-emphasised, that their early enthusiasm needs frank and strong guidance and that, as time goes on, their work tends to become routine unless they continue to receive the same frank and strong guidance. Apart from their work in committee, tours and inspections of the works or department are valuable at intervals which are well spaced. Members of all ranks should be encouraged and to some extent, trained to give short talks, to have discussions with their constituents, to take part in on-the-job safety reviews, special safety campaigns; safety weeks, etc.
CHAPTER IV

CONFERENCES, COURSES AND TRAINING

This chapter gives a few examples of the conferences, courses and training which are included in the safety programmes of some large sections of the chemical industries. The examples have been selected as being typical and varied and they concern all ranks, from senior managers to newly employed youths, from younger managers who have recently been promoted, supervisors who welcome a refresher course, laboratory workers, firemen and all those who might be concerned with fires or explosions and who, therefore, must be trained for these emergencies. There is a short reference to the safety aspects of training for productivity.

Senior Management Conferences

Conferences of this kind enable senior managers and their equivalent colleagues to get away from their works and to exchange opinions and experience, with the important subject of safety as a common background. The chairman is a director of the concern. The safety department's task is simply to organise the appropriate accommodation, transport and – very important – to ensure a strictly timed schedule.

Example I: Programme for a Senior Management Conference for One-and-a-Half Days

The following shows an actual programme based on experience, but adapted.
First Day

<table>
<thead>
<tr>
<th>Time</th>
<th>Subject</th>
<th>Speaker</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.30</td>
<td>Chairman's Introductory Address.</td>
<td>A well-known authority.</td>
</tr>
<tr>
<td>9.40</td>
<td>The social background of industry and management.</td>
<td></td>
</tr>
<tr>
<td>10.10</td>
<td>The role of the State - a general survey.</td>
<td>A distinguished public official.</td>
</tr>
<tr>
<td>10.30</td>
<td>Break.</td>
<td></td>
</tr>
<tr>
<td>10.50</td>
<td>What safety organisation can do for works relations.</td>
<td>A well-known senior industrial director.</td>
</tr>
<tr>
<td>11.10</td>
<td>What the law says about safety in factories.</td>
<td>A specialist with practical experience in industry.</td>
</tr>
<tr>
<td>11.30</td>
<td>Discussion.</td>
<td></td>
</tr>
<tr>
<td>p.m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.30</td>
<td>Lunch.</td>
<td></td>
</tr>
<tr>
<td>2.30</td>
<td>Some safeguards in the use of radio-activity in works.</td>
<td></td>
</tr>
<tr>
<td>2.50</td>
<td>Fundamental health problems in chemical industry and how to deal with them.</td>
<td>An industrial specialist.</td>
</tr>
<tr>
<td>3.10</td>
<td>What works managers think about safety.</td>
<td>One or two senior works managers.</td>
</tr>
<tr>
<td>3.40</td>
<td>Tea.</td>
<td></td>
</tr>
<tr>
<td>4.00</td>
<td>Discussion.</td>
<td></td>
</tr>
<tr>
<td>5.00</td>
<td>Summing up by the Chairman.</td>
<td></td>
</tr>
<tr>
<td>7.00</td>
<td>Dinner.</td>
<td></td>
</tr>
</tbody>
</table>

Second Day

<table>
<thead>
<tr>
<th>Time</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.m.</td>
<td>Half-day visit to a works.</td>
</tr>
</tbody>
</table>

It may be noted that speakers can be obtained from outside or inside the organisation concerned and that time is provided for breaks for informal discussion between the managers, who should preferably not number more than 20 or 25, at most.
Training Courses for Younger Management

Such courses are intended for section and maintenance managers. The main purpose is to ensure, by systematic and planned methods, that younger managers are aware of their personal responsibility for safe practices. A secondary purpose is to make known the services and sources from which specialised assistance or information can be had.

Example II: A Two-Day Training Course for Younger Management

Twenty members, in groups of five, are advised. Adequate time - one-half - should be allowed for discussion. The speakers should be well-known, senior and practical.

Subjects

1. Responsibility for safety.
2. What an accident means - implications and effects.
3. Lessons to be learned from fatal and serious accidents.
4. State law and regulations - common law.
5. Engineering hazards.
7. Special problems in engineering safety.
8. Chemical and health hazards.
9. Fire and explosion hazards.
10. Fire protection and prevention on chemical plant.
11. Accident investigation.
12. Accident case study.
13. Personal protective equipment.
14. Final discussion and summary.

Safe Practices in the Maintenance of Chemical Plants

Planned maintenance is now an important feature in many chemical works. It pays, not only from the point of view of safety, but also in terms of total expenditure. The principle is simple; equipment is removed for servicing and repair at stated intervals. The chances of an accident or a stoppage in production through sudden failure of equipment are much reduced. In many types of chemical plant it is obviously dangerous to allow equipment to run to breakdown point before it receives attention. These are matters in the control of the higher management, but the safety organisation should be familiar with procedures and alert to advise.

Maintenance procedures can be to some extent systematised, but they cannot be automated. They depend on human skills and experience - much of it in manual work. Safety depends on
proper supervision - which includes proper training in safe practices. The job itself, adequately controlled, is the best visual aid. Suggestions for a short course for supervisors in maintenance are given below.

Example III: A Short Training Course for Supervisors in Maintenance Work

1. The Human Aspect of Supervision in Maintenance Work
   (a) Habits and trade traditions - the importance of starting correctly to check and to train.
   (b) Appreciation of possible hazards.
   (c) Importance of clear instructions.
   (d) Dangers from human failings, momentary carelessness, short cuts.

2. Safe Environment
   (a) The worker should only be asked to operate in a safe place.
   (b) The worker should not be required to judge for himself what is a safe place.
   (c) This is the responsibility of supervision.
   (d) How is a safe working place ensured?

3. Control
   (a) Before a job begins an authorised person must certify what are the hazards and whether they still exist.
   (b) The control system must make it a serious offence to work without such authority.

4. Authority
   (a) Safety certificates, permits to work, etc., according to plant conditions.
   (b) Plant clearances after maintenance work.

5. Standards of Special Equipment for Maintenance Work
   (a) Access, including temporary scaffolding, platforms, handrails, ladders, lifting tackle, slings, ropes, etc.
   (b) Tools - regular inspection - immediate replacement of defective or worn tools.
6. Personal Safety Contacts

(a) Awareness of standards of safe practices by workers.
(b) Encouragement of foremen and others in direct charge of workers.
(c) Safety talks and publicity.

Safety Training for Productivity

Any properly conceived scheme for higher productivity involves training in safe practices. Over-enthusiasm or too rigid sectionalisation of function may cause mistakes which are only discovered after an accident has happened.

Any efficiency schemes, therefore, applied to production in the works, should receive the attention of the top management. Works study, time studies, job-evaluation, efficiency ratings, bonus schemes, piece work, are examples. Safe practices are frequently not sufficiently emphasised in conveying instruction or arriving at agreements in these matters. The required results can be achieved by friendly co-operation between the specialist advisers and the safety organisations, and management control should ensure this. Opportunity should be taken, among other things, for interchanges of trainers and lecturers at meetings and courses, e.g. a works study specialist lecturing to safety officers or a safety officer to works study men.

Work Study and Safe Practices

In recent years, the work study system has probably been most discussed and practised as an aid to higher efficiency and wages.

Under proper management guidance, work study can also be used to reinforce the other efforts being made to improve the working environment and the safety conditions in industry. In these conditions, it can be said from experience that work study, carefully installed with the co-operation of all concerned, can and does make for safe practices. Unfortunately, whatever the intention, some courses of work study which are offered to industry, make little or no reference to safety and are accordingly not received with favour by safety specialists.

and others. As previously stated, there should be close contact and consultation between work study and safety organisations, particularly in individual works. Safe practices in the actual work of the factory can obviously be much improved by dissecting the operations into their component parts and examining each one to see whether (a) it is necessary and (b) it is safe?

Efficiency and safety can be secured at the same time, providing sufficient time is allowed and the worker is not permitted to speed up a process which has been timed to permit proper rest pauses over a period of time. This is where proper management control comes in. Work study or incentive schemes are not a substitute for management.

**Fires and Explosions**

Fires and explosions in chemical industries have been brought well under control through improvements in design, measures taken to spread the knowledge of risks, campaigns of fire prevention methods and by fire fighting equipment which is always ready and in which fire brigades (many part-time and voluntary) and workers are given frequent practice. All the technical and supervisory staffs concerned, together with the fire brigade and the workers immediately involved, should be trained to appreciate the risks and to take instant action. In new plants, the higher management should call for an appreciation of fire and explosion risks before the design is approved. In older plants, the risks should be reassessed at fixed intervals.

Each branch of the industry has its own special problems on which to base lectures and demonstrations to those concerned. It is not difficult to arrange demonstrations of small-scale explosions and fires, with methods of extinguishing the latter. These provide dramatic audio-visual aids to safety.

If there are risks of fire or explosion, they should be carefully explained and re-emphasised at regular intervals to the workers. All workers should be fully aware of what to do in an emergency. Fire drills to practise evacuation of the plant by personnel will probably be necessary. Access to dangerous areas must be forbidden to unauthorised persons.

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1 For a fuller study see "Outline of Work Study", British Institute of Management, London, U.K.

Foremen's Training Courses

Such a course might last for, say, 12 weeks, three days of which are devoted to accident prevention. The programme for these three days may be made up as indicated below.

Example IV: Safety Content of a 12-week Training Course for Foremen

(i) Talk and Discussion, Half Day
Types and causes of accidents.
Accident prevention.
The supervisor's influence on accident prevention.

(ii) Demonstration and Participation by Group, Half Day
Manual handling. The "Hickling" or "Kinetic Handling" systems.

(iii) Talk and Discussion, Half Day
The law, factory orders, company rules, etc.

(iv) Case Studies, Group Discussion, Half Day
Human relations in accident prevention.
Film: "Safe as You Think".
Film strip: "The Awkward Customer".

(v) Talk, Discussion and Exercise, Half Day
Investigation and reporting of lost time accidents and dangerous occurrences.
Permits to work.

(vi) Talk, Demonstration and Discussion, Quarter Day
Personal protective equipment.

(vii) Talk and Discussion, Quarter Day
Dangerous substances, chemicals, metals.
Control of issue and use.

(viii) Guarding of Machinery, Quarter Day

1 An audio-visual demonstration by a practised trainer, Industrial Welfare Society, London, U.K.
The "Training Schedule" Wall Chart: 
A Visible Aid to Foremen

A "training schedule" wall chart kept in good condition on the wall of the foreman's office shows at a glance which men have been trained to operate the different jobs, machines, or items of plant in the department or section. It is a simple and effective way of judging the state of training of all workers in the plant. In addition, it has two other important functions:

(a) It is a constant reminder to managers and foremen of the need to train sufficient men for each process, machine or job.

(b) If the foreman is absent for any reason, the wall chart shows immediately which workers have been trained in the different tasks. The possibility of an untrained, or partly trained man, being instructed to operate a job for which he is not qualified is thus greatly reduced.

An adapted example of such a wall chart is reproduced in page 85.

Foremen's Talks to Workers on Accident Prevention

It is usually the task of the foreman to give explanatory talks to his workers on safety matters. Some hints, based on actual experience, about how this might be done are set down below.

Example V: Extracts from a Guide for Foremen

"To help you put over the campaign on safety training, we have prepared some suggested short talks. While the talks are given in full, you should put them over in your own words, and shape them to suit your particular circumstances. Bring in as many examples of accidents, statistics, and so on which have a local appeal as you can, as these are more likely to have an effect on your audience.

"While our first concern is to reduce accidents in our Works, accidents in the home and on the roads continue to injure our people, and practising safety at all times could with advantage be stressed during the talks.

"Make use of such aids as films, filmstrips, posters and exhibitions. Films and filmstrips in particular can be valuable in helping to put over instruction."
<table>
<thead>
<tr>
<th>NO. ... PLANT</th>
<th>Main Control Centre</th>
<th>Process</th>
<th>Weighing and Packing</th>
<th>Conveyors</th>
<th>General Service</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. 1 Operator</td>
<td>Section A No. 1</td>
<td>Section A No. 2</td>
<td>Section B No. 1</td>
<td>Section B No. 2</td>
</tr>
<tr>
<td></td>
<td>No. 2 Assistant</td>
<td>etc.</td>
<td>etc.</td>
<td>etc.</td>
<td>etc.</td>
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<tr>
<td></td>
<td>No. 2 Assistant</td>
<td>etc.</td>
<td>etc.</td>
<td>etc.</td>
<td>etc.</td>
</tr>
</tbody>
</table>

**Workers' names and works numbers**

<table>
<thead>
<tr>
<th>Worker</th>
<th>Works Number</th>
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<tbody>
<tr>
<td>A</td>
<td>009</td>
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<tr>
<td>B</td>
<td>0012</td>
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<tr>
<td>C</td>
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</tbody>
</table>

**Notes**

- **P** = passed efficient
- **T** = under training

General service men are regarded as under training and available for promotion in the department or in another department of the works.

Clearing conveyors at plant exits, labelling and stacking drums, loading transport, cleaning, etc.
"Prepare your talk or instruction carefully and put it over with enthusiasm. Encourage your audience to take part and to give their views and ideas. It is only by working as a team that our aim of safe production will be achieved."

Example VI: Notes for Foremen on Talking to New and Young Starters

"1. Find out first what safety talks, instruction, etc., the new or young starters have already had. You can then decide what can be left out or needs stressing.

"2. Think back on your first days at work, and put yourself in the place of the new worker. He may be nervous, or over confident, and a good start is vital. He has a lot to learn in unfamiliar surroundings and things which seem simple to you, may seem complicated and difficult to him. Keep what you say as short and simple as possible. A little and often is the best way. Follow up your talk at intervals to see if your instruction has been absorbed and is being carried out.

"3. Remember that from the moment he starts work he is absorbing ideas and attitudes - you can help him greatly to absorb the right ideas and the safe attitudes.

"4. Include any special safety achievements of your Works, or points which need stressing."

Example VII: Foreman's Talk to New and Young Starters

"Introduction. Part of my job, and an important part, is to teach you to follow the safe systems of work which are laid down. Now don't get worried and start imagining dangers all over the place, because our accident figures show that you are safer here than on the roads or even in your home." (Note to Foreman: You could bring in here some figures to make the point in your own Works.)

"There are hazards wherever you are, and the important thing is to recognise them, and know how to deal with them. We have a good safety record, and are proud of it, and I want to keep it that way. The management is really keen to prevent accidents, and will do everything it can to reduce them.

"Responsibility. We know that accidents can be prevented, and are determined that ours will be further reduced. But we cannot do it without your help. We work as a team to produce our products, and we work as a team to reduce our accidents."
"Unsafe Practices or Conditions. You can help by reporting to me any conditions or practices which you think unsafe. Don't feel that you may be giving someone away - we all have done something unsafe in our lives, perhaps without even knowing it. The important thing is to put it right before someone gets hurt. You will be given your job instructions, and you will not be expected to do the job until you have been properly trained for it. If you are not sure about anything, you must ask - whatever you do, do not try to muddle along in the hope that it may come right. I am here to help you and I will, provided you let me know.

"Injuries. If you do have an injury - however slight - you must tell me, and have it attended to as soon as possible. There is nothing tough about not reporting a cut - it's plain commonsense to get it fixed up at the Medical Centre. If I know about it, I can check to see that it does not happen again - it might be more serious next time.

"Safety Rules. Just as you need traffic rules on the road, so we need safety rules here. They are there so that we can all work together efficiently and safely. Follow the rules - they are based on experience, and there are good reasons for them.

"Personal Protective Equipment. Personal protective equipment, such as safety boots or shoes, hard hats, eye protection and so on are available. They do prevent many painful injuries - but do wear them properly - for instance if you are doing a job which needs eye protection, do wear your goggles over your eyes - hanging round your neck, they are useless.

"Conclusion. Now don't forget: if you are unsure about anything, do ask. Keep alert the whole time, and you will find the work more interesting and safer. Let me know if you spot anything unsafe, and if you have any minor injury at work, tell me. And follow the safety rules - they are there for the benefit of us all."

Example VIII: Foreman's Talk on Personal Protective Equipment

"The best way to prevent accidents is to eliminate the cause - the hazard. But there are times when we cannot be certain of eliminating the hazard completely, and it is then necessary to wear personal protective equipment to prevent injury."
"In the past we had to improvise to some extent but now there is a very wide range of personal protective equipment available on the market, and it is often quite a job to decide which is best for our particular purpose.

"It is of interest to know how this equipment is chosen. A senior safety officer is responsible for each category of personal equipment, and he decides what articles he considers most suitable, and puts them on trial to see which are best for the job. It is no good producing equipment which won't readily be worn and the users' point of view is therefore carefully considered. Equipment must fit and consequently be comfortable, it must not be too hot or heavy to wear, or even cause the wearer embarrassment.

"It is here that you can be of real assistance. If you are asked to try out a new item give it a fair trial, and don't turn it down out of hand just because it's something new and you consider the old type adequate.

"Any suggestions you may have in this field would be more than welcome - don't worry if they appear to be simple - it's generally the simple ideas that are usually the best.

"The non-abuse or abuse of personal protective equipment is a contributing cause in too many injuries. We cannot say these accidents are entirely due to carelessness, and yet it comes pretty close to it. It is a kind of neglect that we would be pretty sure to condemn in anyone else.

"If you or I were going out into a winter storm we would put on our warmest clothes. When you play football, you put on shin guards automatically, and you wouldn't think of going out to bat without pads and gloves. We would prepare for the experience before us. Every day many of us face some hazards in this department. Every man knows his job and knows what he needs to protect himself while doing his work. We all know that on jobs where flying particles are likely, goggles must be worn to protect the eyes; where heavy objects are handled safety boots or shoes must be worn or it may be simply gloves to protect our hands.

"Without going through the whole range let's take a few examples.

"Eye Protection. Your eyes are undoubtedly the most vulnerable part of your body. Accidents to your eyes can have the most terrible results. Sometimes a flying particle will strike with the same force as a bullet from a gun.
You must all have seen photographs or posters showing specific safety glasses which have saved a man's eyesight, so it does happen and it might happen to you. Men have said that glasses are uncomfortable, but usually this is because they just don't fit. Good fit is important. Whenever your glasses annoy you just remember you can't see out of a glass eye. Not a very original remark possibly but very true all the same.

"Head Protection. There are times when you are exposed to the hazards of falling objects frequently because there are men working above you. These things shouldn't fall but they do - it's not your fault if they drop but you're the one who is on the receiving end. It's rather like driving on the roads - you may be the safest driver in the world but the fellow coming in the opposite direction may not be and whether the crash is your fault or his is immaterial - the result is the same. The new type of hard hat is far from uncomfortable. It is as light and well ventilated as the manufacturers can make it. In fact, in the summer they are cooler than tight-fitting caps or hats.

"Hand Protection. No matter how rugged or tough your hands are, they aren't tough enough to stop slivers or metal or other objects from piercing the skin. As long as your skin remains unbroken, it's an envelope that stops germs from entering the body. Once the skin is opened, they get in and multiply fast and you get an infection that might be very serious. There are of course many other ways of damaging your hands, but the range of gloves is wide and there are kinds available for all types of work. Think how much you do with your hands - they are worth protecting. I have only taken a few examples; there isn't time or the need to consider them all. If however, I have convinced just one of you that the proper place for safety glasses is on his eyes, not on his forehead, our time has been well spent. Who knows, it may have saved his sight.

"Conclusion. There is a very wide range of protective equipment available and it is getting better every day, so get into the habit of wearing it. There is nothing sissy about it - it's just plain good sense."

Safety Monitors in Laboratories and Research Departments

Safety training lectures in laboratory crafts and skills are given in some big chemical undertakings to section heads and to technical officers in research departments. The section heads are responsible for ensuring that all who work under them are instructed in the safe method of carrying out every job they may be called upon to do. To help in this task, each section head has a safety monitor whose remit is:
1. Monitors shall be nominated and supported by their section heads.

2. Monitors shall:
   (a) observe unsafe practices.
   (b) advise immediately on safe methods of working.
   (c) draw attention of the section head to any unsafe practice.

3. Monitors shall report all dangerous occurrences, whether resulting in accident or not, to their section head, the departmental safety officer and/or laboratories administrator or safety committee chairman.

4. Monitors shall assist section heads in training new recruits.

5. Monitors shall encourage good housekeeping and tidiness.

6. In consultation with their section heads, monitors shall take any action considered necessary in the interests of safety.

Safety monitors meet at two-monthly intervals, under the chairmanship of an assistant research manager, the chairman and monitors serving for a period of one year. All technical officers in a section must serve a term as a safety monitor before other ranks are appointed. Thus at some time, every technical officer will have been responsible for taking all the necessary action required for the safe running of his section, and with the section head for the training of new recruits.

The Teaching of Safe Practices on the Job in Laboratories

It is not too much to say that the technical foundations of the chemical industry are based on the work which is done in laboratories. Not only are they staffed by large numbers of trained chemists and others under training, but many distinguished leaders and managers in the industry received much of their early training in laboratories.

The work presents an outstanding opportunity of teaching safe practices on the job and a number of firms have developed special introductory courses of up to 14 days.
Example IX: Subjects covered by Introductory Courses on Safe Practices in Laboratory Work

The following provides an indication of the subjects taught and discussed in one of these courses.

Duties: Laboratory organisation and procedure; responsibility for safety and safety executive committee working; under instruction of technical officer (responsibility for safe working); forethought; unauthorised experimentation; laboratory stewards; housekeeping.

Action and reporting procedures: Accidents - minor; major; dangerous occurrences; fire; unattended experiments (overnight running of equipment).

Notices
(a) Accidents
(b) First aiders
(c) Glass handling
(d) Fire
(e) Handling of corrosive liquids
(f) Broken glass.

Safety equipment (supplemented by demonstration and practice): Eye protection; breathing apparatus; fire extinguishers; fire blankets; skin protection; personal cleanliness; toe protection; special equipment (clothing, etc.); hand protection; alarm systems; eye irrigation equipment.

Glass handling (supplemented by demonstration and practice): Rod - cutting, etc. (including simple bends); tube - cutting, etc. (including simple bends and selection of rubber or P.V.C. tube); corks, bungs - boring - inserting tube or rod; flasks and bottle inspection; carrying of glassware; glass vacuum equipment (including dessicators); care and handling of "Quickfit" equipment; semi-technical glassware.

Simple laboratory equipment and techniques (supplemented by demonstration and practice): Pipettes; equipment fitted with taps (i.e. burettes, separating funnels); aspirators; bottles and winchesters (including labelling and storage); selection and cleaning of glassware (including the use of chromic acid); screening equipment; supporting equipment (stands, clamps, etc.); extraction equipment; Carius tubes.
Heating equipment (burners, hot plates, gas mantles, thermostated baths); simple filtration (including Buchners and traps); simple viscometry. Care and handling of measuring equipment (i.e. thermometers, micrometers, etc.); care and handling of refractometers. Care and handling of balances; care and handling of microscopes.

Handling and care with simple laboratory chemicals (including disposal), e.g. acids (including dilution); alkalis; organic solvents (not including polymerisable materials, but including inflammable liquids).

Bulk handling of simple chemicals: Drums, carboys, storage tanks (demonstration of methods of transfer and charging).

Liquid and solid coolants (supplemented by demonstration and practice): Liquid oxygen; liquid nitrogen; acetone; carbon dioxide.

Compressed gases (supplemented by demonstration and practice): Common gases; cylinders and codes; regulators; manifolds; compressed air.

Radio-active materials: Topics to be chosen by lecturer.

The use and erection of distillation equipment (supplemented by demonstration and practice): Vacuum equipment; traps, etc.

Dangerous chemicals: The use of fume cupboards; toxic hazards; carcinogens; hydrofluoric acid; sodium; potassium and lithium; peroxides and perchlorates; mercury; lead compounds; cyanides; phenols and cresols.

Polymerisable materials and catalysts: Gaseous monomers; liquid monomers; latex; granular polymers; bulk polymers; catalysts and selected information at the discretion of lecturer.

Electrical equipment: Basic electrical safeguards; safety switches; plugs and leads; distribution boxes; fuses; use of low voltage equipment; colour coding of wiring.

Physics division equipment (supplemented by demonstration): Moulding presses; graders and flow test equipment; impact testing hazards; creep test hazards; tensile test hazards; low temperature testing hazards.
Mechanical equipment and procedures (supplemented by demonstration): Simple hand tools; guards; steam heating/ regulators/valves; maintenance orders; clearance certificates; other material according to lecturer.

Processing equipment (semi-technical) (supplemented by demonstration and practice): Disintegrators; extruders; bandsaws and drilling machines; mixing equipment; centrifuges; milling rolls; calendering equipment; autoclaves; drying equipment.

Safety Training of Youths

The importance of the safety training of young workers has been repeatedly emphasised in this report.

In one large firm, the programme given below is followed by a boy from the age of 15 to 18 years of age.

Example X: Safety Training Programme for Youths

1. Two-day General Introductory Course
   (i) Organised by the labour department. The safety officer responsible for youths gives an introductory talk on industrial safety to the boys.

2. Five-day Works Induction Course
   (i) One two-hour period in which the boys are:
      (a) Introduced to the works safety officer;
      (b) Shown suitable films;
      (c) Given a talk on safety followed by a discussion.
   (ii) The boys are told about each area in the works, the products manufactured, the special safety hazards and precautions to be taken.
   (iii) The boys are taken on to each type of job they are likely to encounter and have the safety aspects explained to them.
   (iv) The boys are fitted with safety equipment - mitts, eye protection, shoes, safety helmets and overalls. They are told how to use each item and its importance.
(v) The boys are given a two-hour period on manual handling in which the following takes place:
(a) Talk on manual handling incorporating demonstrations;
(b) Discussion and question session on handling;
(c) A session stacking large blocks.

3. The First Six Weeks

(i) During this period the boys work in groups only. Short safety talks are given at the beginning of each new job. During this period the suitability and reliability of each individual is assessed.

4. The First Six Months

(i) Starting at the end of the first six weekly period, boys have a shop floor safety talk, film or discussion lasting one hour approximately every six weeks - roughly as follows:
(a) Six weeks: talk on habits, film discussion;
(b) Twelve weeks: talk on the individual, film, discussion;
(c) Eighteen weeks: talk on safety and good housekeeping, film, discussion;
(d) Twenty-four weeks: revision and further talk on handling.

5. From Fifteen-and-a-half Years of Age to Eighteen Years of Age

(i) Shop floor talks, safety talks, discussions, demonstrations and films lasting half-an-hour are given at three-monthly intervals. The following are the types of headings for talks:
(a) Talk and discussion of accidents to youths and how to avoid them.
(b) Talk and discussion on accidents, the surgery, the reporting of dangerous occurrences, etc.
(c) Film and discussion.
(d) Revision and talk on manual handling.
(e) General discussion on safety - recent accidents, etc.
(f) Safety and your mates.
(g) Works accidents from the doctor's point of view.
(h) Film and discussion.
(i) Revision of safety aspects learned and the change to working with adults.

(ii) During this period on-the-job safety talks on the correct use of equipment and materials, etc. are given when and where necessary.
CHAPTER V
THE PART OF CENTRAL AUTHORITIES AND ASSOCIATIONS
IN INDUSTRIAL SAFETY

Reference is made in several places in this report to the role of central organisations of different kinds in the field of industrial safety. For practical purposes, these central organisations may be grouped as follows:

The International Labour Office.
Governments.
Government labour inspection departments.
National and state safety societies and institutions.
Manufacturers' associations.
Insurance companies.

The International Labour Office

The information supplied to the I.L.O. from its member countries, together with the visits which are constantly being made to many parts of the world by its officials, make available a large fund of experience of the philosophy and organisation of industrial safety. The work of the I.L.O., particularly in as far as it is concerned with technical assistance to developing countries, has also enabled the Office to make a balanced appreciation of many of the visual aids mentioned in this report. In these last circumstances, technical aid often includes the initiation of schemes of vocational training, sometimes in places where the use of the most simple tools has to be taught. Information on this aspect is also available from I.L.O.¹

On the other hand, in the studies leading to this report, it has appeared that there is a substantial amount of valuable up-to-date information which does not reach the Office. The Chemical Industries Committee may feel that its influence could be extended by suggesting arrangements by which the chemical industries in the various countries could supply the Office with information of interesting developments in the field for the use of the industry in other countries.

Governments

The task of government is, obviously, to initiate legislation with the object of safeguarding, in general terms, the

¹ See also: Introduction to Work Study (Geneva, I.L.O., 1957), Chapter 6, Section 9, pp. 68-70.
safety, health and general well-being of workers during their hours of work. Legislation is enacted for a variety of reasons of which the need to protect the worker against accidents is the main one. Pressure of public opinion sometimes plays a part. However, experience in developed countries has shown that the legislation measures taken are of two orders: prohibitions (e.g. as in the use in manufacture of lead compounds) and directions (e.g. that a named machine shall be so guarded so as to be safe to the operator). In the latter case, the manufacturer is not told how to achieve the object; failure on his part to achieve the object is a breach of the law for which penalties will be exacted. This principle commends itself as placing the onus where it belongs - on the management of the industrial establishment concerned, and it is a function of management to use the specialised knowledge available to it to fulfil the legal requirements.

The Labour Inspectorate

Under various names, labour inspectorates usually are established as a part of a government department responsible to a minister, who is a member of the government. It is, usually, on the advice of the labour inspection department that legislation and regulations are drafted and enacted. Obviously again, the function of a labour inspection department in regard to safety is to ensure, as far as possible, that the law is obeyed. It is as well, however, to record from a practical point of view that if the inspection service is mainly concerned with applying sanctions for non-observance of the regulations, it may secure prosecutions but it may thereby in fact not be making its most effective contribution in securing a reduction of accidents. On the other hand, experience in countries with long industrial histories has shown that labour inspectorates now do their best work in advising and guiding manufacturers and that this advice and guidance is, generally, willingly accepted.

As far as safety is concerned, trained labour inspectors are familiar with the principles which have been outlined in this report, though it could not be expected that in the midst of their duties - usually too many - that they could be acquainted with the details. Nevertheless, some labour inspectorates themselves organise, or associate themselves officially with, safety training courses, and take part, as individuals, in conferences, meetings and training courses where their intimate knowledge of the practical application of legal requirements is invaluable. Many of them are masters of the art of demonstrating with models and apparatus and have developed effective visual aids relating to their special subjects.
Labour inspectorates have their duty as defined by their governments but they can, and do, add great weight to the task of achieving safe practices by the voluntary and semi-voluntary activities indicated above.

National and State Safety Societies and Institutions

Non-profit organisations exist in several forms in many countries and their function is, in essence, to make the best experience available to all their members. They all began in a modest way but in some instances have grown into powerful voluntary societies with thousands of member firms whose own efforts in accident prevention are reinforced and supplemented by the advice and printed matter obtainable from these central sources. They issue posters, booklets, technical information and data sheets, organise conferences and training courses, obtain publicity in the general and technical press, provide films, film strips, etc., material for talks - and sometimes the lecturers - and can provide information and guidance on the matters dealt with in this report, including visual aids. Excellent training courses in industrial safety are conducted by some of them.

These societies and institutions frequently work in a close and friendly manner with their respective state and government inspectorates, to the great advantage of the improvement of industrial safety as a whole.

Manufacturers' Associations

In some countries where large chemical industries exist, the chemical manufacturers' associations have, during the last years, played a most active and successful part in achieving a high standard of safe practices in the industry. They have safety councils and committees consisting of high ranking officials of chemical firms, issue specialised technical safety information to their members, organise conferences, initiate research in chemical safety and hygiene and, in effect, conduct for their members technical safety departments of a high order.

Insurance Companies

Some insurance companies have safety departments or employ safety officers and engineers who are available for general consultation on safety matters by the clients of the companies. Other specialist companies, such as those insuring boilers, have a staff of qualified engineers who conduct statutory and other inspections. The system has much to commend it if it operates with the safety organisations which should exist in individual factories. 1

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The Part of the Trade Unions

It has been made abundantly clear in this report that the primary responsibility for safety programmes and for the teaching of safe practices by the best means available rests with management. However, the willing co-operation of the worker is also essential, and in this matter the workers' organisations have a most important part to play.

In the first place, the workers' leaders can do much to overcome indifference on the part of the individual member, and even more, a certain reluctance on the part of many a worker to take part in safety activities or to observe even ordinary precautions lest he lay himself open to jibes by his fellows. If the leaders, trade union representatives and shop stewards show their interest in safety programmes, themselves set the example, and encourage their workmates to follow, a change in outlook can be secured and genuine co-operation on the part of the individual member is the more likely. Trade union members are certainly more willing to play their part if their own leaders encourage them to do so than if they view the whole safety programme as purely management-inspired.

Further encouragement can be given by the participation of trade union leaders in special safety campaigns, and their presence at safety exhibitions, in addition to other ways in which they can demonstrate their interest in the matter. Suitable articles on safety subjects in trade union periodicals are also of great value in this regard. Such articles should make use of whatever illustrated material is available in order the better to impress their readers.

The desirability of associating the workers in the promotion of safety was already expressed by the International Labour Conference in the Prevention of Industrial Accidents Recommendation, adopted in 1929. It was here pointed out that the workers, by their conduct in the factory, could and should contribute to a large extent to the success of protective measures. The State - and it must be recalled that the Recommendation was addressed in the first place to governments - should therefore use its influence to ensure that the workers' organisations should, by using their influence with their members, co-operate in accident prevention work.1

The Conference further stated that encouragement should be given to co-operation in the promotion of safety between management and the workers in industrial works, and of employers' and workers' organisations in the industry with each other and with the State and with other appropriate bodies by such methods and arrangements as may be best adapted to the national conditions and aptitudes.\(^1\)

Encouragement to observe safety measures is, however, not enough. It is also the task of the workers' organisations, or their representatives in the plant, to draw the attention of management in the first place to practices which are contrary to regulations, or which they consider unsafe. In the event of no suitable steps being taken to remedy such situations, the attention of the labour inspectors may have to be drawn to them. Further, the trade union may receive observations or complaints from its members, and its officials may have to look into them and judge how far they are well-founded.

The International Labour Conference has, in fact suggested as one of the possible methods of collaboration between the States and the employers' and workers' organisations in such matters the appointment of a safety supervisor by the workers.\(^2\)

In many countries, however, the arrangements for co-operation are somewhat more formal. The International Labour Conference in 1929 mentioned the establishment of works safety committees as one of the possible forms of co-operation.\(^3\) Later, when dealing with labour inspection, the Conference again recommended that arrangements for collaboration between employers and workers for the purpose of improving conditions affecting the health and safety of the workers might take the form of safety committees set up within each undertaking or establishment, and including representatives of the employers and the workers.\(^4\)

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2 Ibid.

3 Ibid.

In a number of countries, joint safety committees are in fact required by law in undertakings employing more than a specified (and relatively small) number of employees. This is the case, for instance, in Belgium, Denmark, France, Mexico, and Spain.

In other countries, the setting up of such safety committees is optional, though there is often official encouragement to such action. There are, however, a number of examples of joint safety committees in action in countries such as Austria, Canada, the Federal Republic of Germany, India, Italy, Sweden and the United States.

These joint safety committees usually act in an advisory capacity only, and their usefulness in bringing unsafe conditions to light, and in stimulating the interest of both management and workers in the promotion of safety has been amply demonstrated. Their composition and terms of reference no doubt vary from country to country, and even from one undertaking to another, but they may frequently include some or all of the following elements:

1. the study of accidents which have occurred, of the reports thereon, and of the best means of preventing the recurrence of similar accidents by eliminating their causes;

2. general advice aimed at improving safety conditions; and

3. the development of safety consciousness in the undertaking, including proposals for safety courses, training

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1 Order of the Regent dated 3 December 1946 (J.S. 1946 - Bel. 6).


3 Decree of 1 August 1947.


methods and safety campaigns, which may make use of the audio-visual methods described in this report.

The members of the joint safety committees may, on occasions, undertake tours of inspection of the works, or a department thereof, to report on general conditions and unsafe working methods.

One example of useful work carried out in a plant where a joint safety committee was active is provided from India. In the Bombay factory of a large chemical concern, the frequency and severity of accidents fell dramatically from 28.00 to 0.93 and from 2247.00 to 84.22 respectively between 1951 and 1959. This result was attributed at least in part to the efficient activity of the firm's joint safety committee.

In some countries, the part played by the trade unions is even more important. In the U.S.S.R., for instance, while the primary responsibility for safety measures rests, as elsewhere, on the management - in this matter there would not appear to be any major differences in outlook between countries - the trade unions are entrusted with the duty of ensuring the observance of safety regulations and supervising safety conditions. They report to the management when, in their view, conditions need to be remedied.

In cases of serious violation of labour protection and safety rules or of labour legislation, the trade union has the right, in virtue of Article 49 of the Labour Code, to demand that the persons responsible be dismissed. Such a demand on the part of the trade union has to be acted upon by the administration of an enterprise or institution and can be appealed against only by lodging a complaint at a higher trade union level, whose decision is regarded as final. In actual practice the Soviet trade union organisations make use of this right to demand of management that they carry out the measures aimed at improving labour conditions and improving the safety precautions included in the collective agreements.

The handling of safety, health and welfare problems is, in fact, one of the principal functions of trade unions in that country. Safety committees and technical inspectors are nominated and chosen by the trade unions which have at their disposal research institutions with qualified scientific personnel in the main industrial centres.

It is clear that wherever the workers' organisations play or aspire to play an important part in securing the observance of safety measures, they should have on their staff persons technically capable of presenting justified grievances in the matter in a correct manner, and of eliminating complaints which have no foundation, explaining the position to the members who presented them. The trade union officials or representatives therefore, should have themselves received some training in safety matters, both as regards the scope and purpose of regulations, and as regards the risks involved and the best means of protection against them. This experience may be acquired by participating in courses organised by management. But in many cases, the union may itself find it expedient to conduct educational courses on safety as part of their workers' education programme, for both its present and future officials, representatives, shop stewards, members of safety committees, and its members. In this task, the use of many of the audio-visual aids advocated in this report may be of very considerable assistance.

To help in the task of organising such courses, the International Labour Office has produced a workers' education manual on accident prevention, available in English, French and Spanish, with specific lessons on the most important and current aspects of the problem.¹

From the above it will be seen that the workers in their organisations have their part to play in the promotion of safety organisation. In consequence, the audio-visual methods of training for safe practices in the chemical industries should be so designed so as to reach those workers who are participating in these activities, so as to enable them to be knowledgeable in this field and to be adequately trained to shoulder their responsibilities and to carry out the tasks with which they have been entrusted.

CHAPTER VI
GENERAL REVIEW

The special manufacturing problems in the chemical industries have given rise to close studies of methods of achieving high standards of safety. Over the last years the incidence of accidents has been greatly reduced in many large firms. In these firms most of the hazards inherent in the processes have been brought firmly under control and accidents from technical causes, happily, now rarely happen. This good state of affairs has only been reached by long and patient efforts to inculcate safe practices among all ranks. The present report deals with some of the main methods adopted and discusses audio-visual aids as means of making the necessary training and teaching more effective.

The need for constant vigilance and a continuous programme of training and reminder, together with the importance of an active safety organisation, are evident from studies of the safety plans and records of successful firms. It is clear also that the high standards which have been reached in these cases would not have been possible without the active support and example of the higher managements.

Ideas are presented which have proved their value in large and small works and it should be found possible to adapt many of them to the needs of branches of the chemical industry in all stages of development.

The Background for Management

The differences in states of development and traditions in the chemical industries of the world necessitate a brief survey of some factors influencing safety which are of particular significance in the creation of policies by higher managements. In the space of a generation there have been great changes in the techniques of design, construction and operation. There has been great progress in the relation to the training of personnel of all ranks and in labour-management relations. This has included the adoption of many and varied schemes of induction, training, teaching and comprehensive safety programmes.

Managers and technicians have, for a long time, been well qualified academically. Supervisors and foremen were qualified by protracted backgrounds of experience. The demands on such leaders today are conditioned and expanded by constant changes both in processes and organisation. There has arisen a recognition that new measures complementary to practical experience are necessary to meet the situation which arises in modern industry.
It is also true that the policy of managements in this regard, and the respect of regulations, calls for the understanding and co-operation of the workers concerned and of their organisations. The latter can encourage their members to take safety seriously, to join in courses of instruction or training arrangements provided, and to take a pride in the pursuit of safe practices instead of, as occasionally happens, treating them with scorn. Some trade union representatives or shop stewards can also be trained to know about safety problems so as to be able to assist in bringing to light situations which are not in accordance with the standards required and to encourage the participation of the workers in safety programmes. Finally, in some countries, joint safety committees have been set up, either in accordance with law or on a voluntary basis.

As far as senior and rising managers are concerned, the subject of safe practices takes an important place in technical manuals, engineering codes and regulations and detailed operating instructions. In past years many accidents have occurred through lack of such guidance. Visual aids as such are not at present much used for high grade professional staffs, though there seems to be no reason why special research into this aspect should not be undertaken. On the other hand, the use of scale models of factories and layout is becoming more common and though for commercial reasons these are not generally available for public information, they have been found to be a most valuable adjunct to engineering drawings. There are many examples of errors which have been incorporated into plants which have been built from drawings. It is clear, for example, that the siting and spacing necessary in chemical plants is quickly perceived from models.

Developing Countries

Of major importance in developing countries is the importance of visits by technicians who have gained their academic qualifications to chemical industries with long histories and experiences, including those of trial and error, which have contributed to present knowledge. There is much in every-day practice which cannot be gained from lecturers or books, essential though these are in the training of professional technicians.

Several of the countries in which there is considerable experience of chemical industry provide a valuable service in selling complete parts together with what is called "know-how". Such plants are also bought for various reasons by countries which are already highly developed and it is the general experience that some of these plants have their troubles before they reach full production. Bearing in mind the complexity
of many operations, this is to be expected and it is therefore essential that technical staffs should have personal experience of the operation of similar plants in other countries. The best audio-visual aid in this vital matter is to see the job done and to have it explained. It should be possible to arrange this through fellowships under the technical assistance programmes or by arrangement with chemical industries in developed countries or with the manufacturers of the plants.

**Specialised Workers**

Automation in the chemical industry is no new thing and the tendency is for the number of workers involved in the actual production to be comparatively small. Such workers require special training if they are to attain a quick grasp of their functions. Specially designed audio-visual aids such as reproductions of the observations and reactions which are required of them can be most valuable. The best audio-visual aid, however, is a good supervisor who has been properly trained.

**Foremen**

Whole-time courses of several months for foremen are by no means uncommon. They are intensive and are probably best suited to younger men whose minds are still flexible and capable of taking in knowledge. With older foremen there is a good cause for special training in safety. In both instances audio-visual aids should be fully employed.

**Maintenance, etc.**

In maintenance, alteration, repair and demolition, constantly in progress in a chemical works, there are types of operation which cannot be automated. There are many dangers which can mostly be avoided by well considered operating procedures and proper supervision, training and instruction. Many firms have devised special courses for supervisors responsible for these tasks.

**Normal Technical Hazards**

In every chemical works there are hazards arising from the use of electricity, power houses, boiler plants, transport and traffic. In addition, there may be dangers rising from the packing and transporting of chemical substances, in which case special instructions and training must be provided. They must also be included in the subjects requiring continual reminders through the management and the safety organisation if a good standard of safety is to be achieved and maintained. Visual aids are of considerable value in training and reminding personnel of such risks.
The Main Causes of Accidents

Even in the most highly developed industries with the greatest success in accident prevention, it still remains the case that about two-thirds of all accidents are attributed to falls of persons, falling objects and handling material. The total of such accidents can be, and has been, much reduced in many works but only through constant pressure, propaganda, reminder, job analysis and training.

Reactions of Personnel

If the chiefs of an organisation make it clear that they expect high standards of safety and that they consider the matter of sufficient importance to give some of their own valuable time to show their personal interest, there is generally a noticeable reaction among the technically qualified staff and supervisors. There are instances where this attitude has been integrated in the professional approach to management and supervision.

Apart from any special precautions in which they have been trained in relation to the particular work which they have to perform, the situation is that every possible device has to be brought into play constantly to remind the workers of the ordinary risks which are to be encountered in any works. These risks are no greater than - and are probably less - than those to be met on the public roads but the fact remains that they account for most accidents, and can only be reduced in severity by an active safety organisation which provides constant reminders and a flow of new ideas for training and publicity.

Some Basic Principles for Managements in Planning for Training in Safe Practices

Audio-visual aids, considered in the widest sense, are only additional to the organisation and training necessary to bring about a high degree of safe practices. A practical knowledge of the industry and of this special aspect are necessary, as well as an appreciation of local conditions and characteristics. It is generally valueless, and frequently harmful, blindly to copy the practices of another country. There are, however, certain principles which apply in all countries.

1. Safe practices are the concern of all ranks in industry.

2. A good safety record stems from an explicitly expressed policy by top management.

3. Pursuance of that policy by works managements.
4. Practical application of policy by research staffs, designers, and technicians.

5. Personal example and leadership in safe practices by all managers, supervisors, and foremen.

6. Active participation and co-operation by the workers.

A long-term plan is essential. Safety is not to be had merely by the exhibition of posters and the occasional showing of a film.

Safety Organisation

This is not a casual matter to be allocated to some person who happens to be available. A well-trained safety officer who has the character which fits him for the job is a good investment. His training will include something of the art of teaching and of the use of teaching aids. He should be able and willing to pass on this knowledge to colleagues, supervisors and foremen who can, in turn, influence and instruct those in their immediate charge. Facilities for training safety officers, industrial teachers, and trainers should be available through governments, international organisations, employers' associations, trade unions, and voluntary welfare and safety societies, and also large industries. The men concerned should be able to command confidence and respect and to talk on reasonably level terms with all ranks. The highest successes have been achieved by safety officers whose function is advisory and not executive. Safety is actually achieved directly by managers, technicians and supervisors who secure the active cooperation of the workers in their charge. The personality of the leading safety officer, trainer, or other official must be such that he does not interfere with the line of command. To the worker, the first line of command is his foreman, and all organisation and training — including those for safety practices — should be consciously aimed at making the foreman's task easier and more efficient. He is the key man.

The Real Causes of Accidents

The advance to a really high standard of safe practices depends on the extent to which those in control are willing to authorise the severe analysis which is necessary to establish the real causes of accidents. If, for example, these are classified under the headings of design, construction and operation, supervision and training, and personnel there come to light many faults of omission by the management and supervisors as well as the workers and it takes a great deal of mutual confidence to make such a system work. Such analyses cannot be
undertaken until attention has been devoted for some time to the more obvious causes of accidents, and if it is established from the beginning that the sole reason for inquiry and analysis is to prevent a recurrence of a type of accident, confidence will gradually grow. It is the general experience that such a system can only be operated inside a firm or a works and not through an outside central organisation.

Audio-Visual Aids

The following is a summary of the audio-visual aids which are available for the teaching of safe practices. It includes notes on their use and limitations.

Posters

A poster is rarely read. It should convey its message in one or two seconds. Regular inspection of posters is essential. A torn, dirty or badly fixed poster creates a bad impression. The effectiveness of posters is not great but they are essential. They must relate to the country in which they are exhibited. Their cost is low.

Poster Boards - Small

Poster boards should have care taken in their design and be regularly inspected. An untidy appearance is bad. The cost is low to medium.

Notice Boards - Large

Every works should have one very large board placed in the most advantageous position, usually near the entrance. Valuable for advertising in very large figures accident records, special campaigns and the like. They should not be used for ordinary posters. The cost can be low, the object actually being to change the form of the board from time to time.

Safety Trophies

These have found to be very effective. They vary from simple flags or pennants to fine plaques, cups, etc. They should be exhibited where the workers can see them.

Notices and Colour

Warning Notices

These are good if used for temporary conditions, e.g. "DANGER - MEN WORKING OVERHEAD". Some permanent notices may be necessary by regulation, e.g. - "NO SMOKING" or instructions
for operating a grinding wheel. Other permanent notices such as "MIND YOUR HEAD" or "BEWARE OF TRAFFIC" are not recommended. They mostly indicate design or management faults. The cost is low.

**Colour on Guards, Safety Devices, etc.**

The use of one distinctive colour for machine guards, transmission guards, guard rails and wire fences, fire-fighting appliances, wall boxes containing protective and first-aid equipment, is strongly recommended. Opinions differ as to the colour to be used; it is usually red or green. The guards and equipment mentioned must be kept clean and the removal of all equipment of these types subjected to special rules and discipline. The cost is low.

**White Lines in Gangways, etc.**

Now regarded as essential in a well conducted works. Strict discipline must prevail to ensure that gangways, roadways and stairways are kept free from obstruction. Regular inspection is needed. The cost is low.

"Real-life" on the Job

Probably the most valuable audio-visual aid is the demonstration of efficient and safe practices on the actual job and every opportunity should be taken of so doing. However, noise in the works or the nature of the process may make this difficult. This is particularly important for new and young workers.

Off the Job

"Real-life" aids taken from the works are most effective when demonstrated in the lecture room. Chemical manufacture can be reproduced or simulated, and cut-aways of plant, machines, valves, pipes, flanges etc., can be used. Safety equipment, together with examples of worn, damaged and dangerous tools and equipment should also be demonstrated. The cost is usually high.

**Models**

Some items are too big or too small for demonstration in lecture rooms, in which cases models are sometimes used for special training. The method is highly effective but the cost is considerable.

"Mock-ups"

A form of model which, while not actually resembling the thing closely, demonstrates the principle, e.g., simulation of chemical processes, using glass apparatus, molecular models,
miniature dust explosions, gravity conveying, mechanical and manual weight lifting. These are most valuable for special training but the cost is usually high.

**Blackboards or Chalk Boards**

With a good instructor one of the oldest and one of the best for small classes. Many ingenious types, including sliding and hinged panels, roller types including cine-screens, are available. Apart from the instructors' time, the cost is low.

**Tear-off Sheets**

A pad of large sized cheap paper on which a skilled instructor can draw with a waxed crayon, each sheet being torn off and set aside for use as required. An excellent adjunct to the chalk board. The cost is low, apart from the instructors' time.

**Flip Sheets and Safety Graphs**

These are large (6 sq. ft.) or small (about 3 sq. ft.) sheets on which drawings, charts and wording are printed in advance. Each sheet is flipped over the blackboard or similar arrangement to reveal the next aspect of the project. In the safety graph the lecture is printed on the back of each sheet. It is valuable as early training for those who have to give talks or lectures to small classes. The cost varies from medium to high.

**Pin-ups, Flannel Graphs and Magnetic Boards**

The principles of these are roughly the same in that a series of parts of a unit are pinned or placed up to form a complete presentation. The reverse process can, of course, also be used. With the flannel graph and the magnetic board the pieces which go to build up the lessons are simply placed on the boards to which they adhere, apparently defying gravity. Their effectiveness is good for small classes if they are not used too frequently. The cost is low to medium.

**Photographic Aids**

The services of a good photographer are most valuable as an aid to safe practices. Enlarged photographs which can be displayed, smaller pictures in the works magazine, prints for small meetings such as safety committees and material for projection, can be available. Specially useful in special campaigns, safety weeks, etc. if big enlargements can be made.
After-hours Camera Tours

Shock treatment can be administered by taking good photographs of bad practices after general work has ceased and exhibiting them as above.

Projectors

All projectors should have a powerful source of light and throw a big picture.

Slides and Film Strips

These are valuable, cheap and easy to store and especially useful for case studies in small classes with plenty of discussion among the audience. Colour film strips and slides should be used wherever possible. The projector should be the best which can be had but an expensive camera is not necessary. According to circumstances, the commentary may be by lecturers from notes or memory, or through a tape recorder. The latter sometimes attracts attention as an ingenious device.

Overhead Projection

This has advantages (a) the lecturer can face his audience (b) the lecture room need not be darkened (c) the movement of the material projected is possible, because transparencies are placed over a glass panel illuminated from below. Stroboscopic wheels in front of the lens can impart movement, e.g. liquids in pipes. A practised speaker-operator is advisable, also a powerful light source. The cost is relatively high but the device is valuable.

Opaque Projection

Opaque projectors (epidiascopes, etc.) are still regarded as valuable by many trainers. They are bulky, and need a darkened room, together with a powerful light source. The cost is medium to high.

Films

Generally speaking, films must relate to the country in which they are shown, which means that they must be made either by professionals or amateurs to suit local conditions. Colour has a much greater impact than black and white. Commentary may either be recorded or successfully spoken by the demonstrator. The projector must be the best which can be had; the camera need not be expensive. "Home-made" films are often of high value in individual factories. The cost varies from very high to quite low.
Television

There is a promising future for closed-circuit television for off-the-job training where conditions in the works can be reproduced on a large screen without the distraction of noise. Note should be taken of the increasing use of coloured closed-circuit television from hospital operating theatres. Class-to-class television has been successfully used. This means that one lecturer-demonstrator can deal with two or more classes. The cost is high.

Speeches, Lectures, Addresses, etc.

The value of these varies very greatly. They can be classified as:

(a) a few words on appropriate occasions or opening addresses at large meetings by well known members of top management;

(b) addresses by experts to chosen audiences;

(c) very short talks on special occasions to workers.

Long speeches and exhortations to workers should be avoided, and most of the time should be allocated to the use of one or more of the audio-visual aids.

Safety Handbooks

For general risks such as are met in any factory these are good in the early stages of safety organisation. They should be profusely illustrated. A second type is valuable for new employees and young workers. These are excellent where there is a proper training system; otherwise they are of no great use. The cost is medium to high.

Safety Manuals

A most important group of handbooks dealing with specialised operations performed by workers who have been trained or are undergoing training for particular tasks, e.g. riggers, painters, crane drivers, shunters, scaffolding and staging for maintenance purposes, breathing apparatus. They are only of value when associated with systematic training. It will be realised that many specialised workers operate as individuals; supervision can only be light. The cost is medium but the value in the right circumstances is very high.

1 The Hayes and Harlington Closed-circuit Television Experiment, Central Office of Information, London.
Process Operating Instructions

These are vital in many branches of the chemical industry. They are naturally mostly regarded as being in the nature of trade secrets but some guidance can occasionally be obtained. They imply close supervision and intensive training on the job by competent foremen and supervisors. They are an essential part of production. In the chemical industry there is no clearer example of a "real-life" aid on the job. In laboratories and semi-technical plants operating instructions are issued as regulations, and again are not usually available publicly. Some information can occasionally be obtained through international introductions, manufacturers associations and personal contacts and visits. This is a most important aspect of safe practices in the industry.

Engineering Codes and Regulations

The model Code of Safety Regulations issued by the I.L.O. provides a practical summary of many aspects, and others produced by chemical firms are sometimes available. These codes and regulations have a high value.

Data Sheets and Technical Information

These are sometimes to be had from the manufacturers' associations in countries with advanced chemical industries. Model rules, for example, provide a succinct guide to the necessary disciplinary and technical measures and rules for the design, construction, operation and maintenance of plants with risks from fire, explosion, gas vapour, fume, dust, corrosive substances. The chemical safety data sheets of the Manufacturing Chemists Association, Washington, U.S.A., set the highest standard in giving the essential information for the safe handling and use of a large number of chemicals. Information can be had from the manufacturers' associations and the national safety organisations.


2 See also "Safety in Chemical Laboratories", Manufacturing Chemists Association, Washington.


4 The Royal Society for Prevention of Accidents, London, U.K.
Safety Periodical Publications

The issue of these is increasing in many countries. They provide good material for information and adaptation and are usually obtainable at low cost. The large national safety organisations are the best source of inquiry.

Special Campaigns: Safety Weeks

These are valuable if there is a background of safety and the organisation is good. They should be used at infrequent intervals to attract the attention of the workers and to demonstrate the interest of the management. Experience is available in the countries with advanced chemical industries.

Exhibitions

Permanent exhibitions in works are not advised but temporary exhibitions used in conjunction with the special campaigns etc. mentioned above can be of high value. Good information can be obtained from the large national safety organisations. Some degree of professional skill is necessary. The cost is medium to high.

Organisation for Safe Practices

Top management's part in the achievement of safe practices is to examine principles, to determine major policy, to include safe working as an integral part of production and to check results at intervals. Executive action is delegated to a senior individual or to the works manager. Success or failure then depends largely on the advisory safety organisation, whether it consists of a part-time safety officer and trainer in a small firm or whether it grows up to a staff of several persons in large ones.

The safety organisation, or whatever equivalent may be used, has a wide field of contact, training, persuasion and reminder. In time all ranks are drawn within the orbit either making some personal contribution to safety, or receiving training, or both. Safety organisations have tasks which are remitted to them, such as the elementary approaches to safe practices. Others, they can only achieve by patience, tact and gaining respect. In time they should be able to influence the calling of meetings of senior managers for the sole purpose of discussing safe practices. Down the line, remembering that the junior supervisor and technician of today is potentially the senior man of tomorrow, the safety organisation will take all opportunities of participating in the training, conferences and meetings which are arranged for different grades and professions. Examples are:
1. senior managers, assistant managers and works engineers;
2. plant (large section of works) managers, maintenance managers;
3. research staffs responsible for large laboratories, research departments and semi-technical plants;
4. younger technical staffs, section heads and other supervisors with university education or equivalent;
5. foremen, assistant foremen and charge hands;
6. induction courses for new and young workers.

Additional Aids to Safe Practices

In addition, a constant flow of ideas is necessary, for example -

The manager's safety visit. A walk round the works or part of the works by the senior manager or one of his assistants, with the one idea of safety in mind, and a short personal talk with department heads and foremen, has been proved of the highest value.

Tours by safety committees. These are most valuable if they are not allowed to degenerate into routine.

Job safety reviews. These vary from highly technical evaluations of new and changed processes or re-evaluation of existing processes to relatively elementary - but equally essential - surveys of parts of processes, maintenance and general work in which danger has been perceived or the standard of safety allowed to deteriorate. Mixed teams of professional staff, foremen and workmen have been engaged in such reviews.

Works safety committees. The inspiration for works safety committees is usually provided by an active safety organisation, which should unobtrusively provide the motive forces, at least in the first stages. As time goes on, provided that there is a determination not to allow the proceedings to follow routine patterns, these committees can become powerful influences indicating the genuine co-operative spirit which exists among all ranks.

In many countries, these safety committees are joint, consisting of persons appointed by management and by the workers organisations.
Conferences, Courses and Training

With the support of the management the safety organisation, whatever form it takes, is concerned either directly or in association with other departments with many kinds of conferences, courses and training. These may vary from semi-informal meetings of senior managers, short safety training courses for younger managers, short courses dealing with the maintenance of chemical plants and similar specialist matters. In addition, the question of safe practices enters into schemes for obtaining greater productivity, i.e. work study, time studies, job evaluation, efficiency ratings, bonus schemes and the like. The management should see that the safety organisation has a part in these works matters. The same principles apply to special training courses such as those for foremen, laboratory assistants and young workers. Special attention may have to be paid to the provision of guidance for foreman who have to give safety talks to the young workers newly in their charge.

Special training may also have to be given to deal with such emergencies as fires, explosions, escapes of gases, etc. as well as the correct use of the personal protective equipment provided.

Safety organisations with some experience can also give valuable service outside their own firms by co-operating and demonstrating at local and national meetings, conferences and training courses.

Audio-visual aids are valuable adjuncts to all the activities mentioned above.

* * *

It will have been seen by the above that attention to safety is of the greatest importance. In this matter, while the co-operation of management and of the workers at all levels is necessary, direction and guidance must come from higher management, working through specialised safety officers, and, of course, the usual line of command in which the foreman plays a vital part.

Because the mind is more markedly impressed by pictures and models than by the written word, audio-visual aid can, by striking the imagination, play a vital part in the teaching of safe practices.

It is by a real keenness on the job, a suitable organisational structure, and above all by the imaginative use of all the audio-visual devices that can make a lasting impression on those concerned, that lives can be preserved and injuries avoided, with all the suffering they entail.
POINTS FOR DISCUSSION

General Considerations

1. Training in safe practices essential in the chemical industries.

2. Importance of considering recent technical and organisational developments in the chemical industries in relation to all aspects of training for safe and efficient work.

3. Desirability of recognising that safety in production is the concern of all ranks in industry and that specific training should be provided for all ranks and not only for the workers.

4. Importance of completely frank and factual analysis of all lost-time accidents (not only serious and fatal) and necessity to build up confidence and co-operation to ensure this.

5. Value of audio-visual aids in safety training.

6. Desirability of adapting and using methods which are related immediately to the work of those engaged in the industry or individual factory and which, as a result, grip their attention.

7. Importance of realising that audio-visual aids are only a part of well considered schemes of training and instruction.

Special Considerations

8. Inclusion among the matters to be considered of the following items in particular:

(a) at the stage of construction of plant and equipment and for those planning such construction and supervising its execution: mastery and design, construction and operational processes, with indication of the technical and constructional hazards to be avoided;

(b) at all levels and all stages of production:

   (i) ordinary preventive measures or precautions, including shop tidiness and good housekeeping, attention to minor injuries and action to be taken in the event of accidents,

   (ii) knowledge of the process, or the exact working procedure to be applied;
(iii) special hazards to be avoided;
(iv) recognition of noxious substances;
(v) importance of safety aspects in work study, job study (T.W.I.), incentive schemes, etc.

Audio-visual Devices

9. Consideration of the usefulness of the methods described in the report and indication of any advice to be given in connection with their use, including mistakes to be avoided:

Posters;
Safety notice boards;
Safety trophies;
Warning notices;
The use of colour in factories.
Safe practices demonstrated on and off the job;
Models and "mock-ups";
Blackboards, tear-off sheets, flip-sheets, pin-ups, flannel graphs and magnetic boards;
Safety graphs.

Photographs and after-hours camera tours;
Slides and film strips;
Overhead and opaque projections and films.

Use of television (general programmes, closed-circuit television in the works, television from one class to another).

Speeches, addresses, lectures, lecture notes, etc.

Safety handbooks and safety manuals;
Safety codes and regulations (for process operations, laboratories and semi-technical plants);
Engineering codes and regulations;
Safety rules, information and data sheets.

Special safety events in works (competitions in accident rates and tidiness, special campaigns and safety weeks);
Exhibitions.

Inclusion of Safety in General Training

10. Inclusion of safety measures in the training provided by the chemical industries and large corporations for chemists and engineers, together with measures to train these technicians in acceptable methods of instruction of their subordinates.
11. Special training as instruction for safety officers and safety staff.

12. Inclusion of safety measures in the training provided for foremen, together with measures to train foremen in the use of visual aids for training their men in production work, including safety.

13. Inclusion of safety measures in the programme of training of workers.

14. The inclusion of safety factors in systems of work study, training-within-industry instruction programmes and other methods aimed at increasing productivity.

15. Promotion of the discussion of the use of audio-visual methods at national and international safety conferences, illustrated by special exhibits.

The Part to be Played by Various Bodies

16. Importance of co-operation by various institutions in the promotion of safety training of the use of audio-visual methods.

17. The role of government departments and labour inspection services:

- encouragement of the use of audio-visual methods safety instruction and training; or
- making available through the publication of abstracts and by other means the experience gained by labour inspection services,
- making available experience gained in other countries.

18. National safety societies and institutions:

- discussion of suitable methods of audio-visual training,
- provision of audio-visual material of a general character.

19. The role of employers' organisations:

- preparation and distribution of suitable material, conferences, technical safety services.

20. The role of workers' organisations:

- encouragement to their local branches and members to co-operate in arrangements for training in safe practice by audio-visual methods
- participation in joint committees
- training of leaders and some senior members in safety matters.

21. Factors in works organisation:
- meetings of senior management and technicians
- meetings and conferences of engineers and technicians, construction engineers, plant and section supervisors at the time of planning, research, construction and of getting "on flow".
- the role of the foreman.
- safety officers.

22. Joint works safety committees possible composition.

23. The role of the International Labour Office:
- making available experience gained in various countries in the use of audio-visual methods in teaching safe practices.
- making available information on safe practices and on typical accidents.
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Grateful acknowledgement is made to the authorities and institutions of many countries with established or developing chemical and similar industries. Their experience, as represented by their publications, has been examined and personal contacts made with several of them, in particular France, the Federal Republic of Germany, Italy, the Netherlands, the United Kingdom and the United States.

In relation to the actual visual aids mentioned, the International Labour Office has been greatly assisted by the following institutions:

- The Royal Society for the Prevention of Accidents,

- The National Safety Council,
  425 North Michigan Avenue, Chicago, U.S.A.

- L'Institut National de Sécurité,
  9 Avenue Montaigne, Paris 8e, France.

- L'Association des Industriels de Belgique (A.I.B.),
  29 Avenue André Drouart, Auderghem-Bruxelles, Belgium,

and by the publications of:

- The British Association for Commercial and Industrial Education, London.


- The Overseas Visual Aids Centre, London.

The report would not have been written without the generous co-operation of some large chemical and other concerns which have taken a leading part in developing industrial management practice, in establishing labour-management relations procedures and in dealing with safety. Much information, which is generally not made publicly available, has been placed at the disposal of the Office, which here expresses its sincere thanks.

Many manufacturers and distributors of audio-visual aids have supplied details of apparatus and equipment. This has been of most valuable assistance in checking and evaluating the items mentioned in Chapter II - Visual-aids. Information concerning specific aids which are available commercially can be...
obtained from the national institutions and societies whose names are given above and from similar bodies in other countries.

Government, state, local and other authorities concerned with general and technical education, television, radio, educational and documentary films, etc. have provided publications dealing with their current programmes. These have enabled the Office to make comparative studies of different methods of conveying information, with the object of presenting a balanced picture of the specialised aspect with which this report deals.

References

As regards the use of audio-visual aids in teaching safe practices in industry, the best sources of information are as a rule the national institutions and societies concerned with industrial accident prevention. These exist in many countries and are generally in contact with similar institutions in other countries. They are generally in close touch with chemical industries and can either provide or obtain specific information.

Information on safe practices necessary in specified branches of the chemical industries is generally to be obtained from manufacturers' associations.

The I.L.O. also has some specialised information or is in contact with sources from which it can be obtained.

Short Bibliography

Pamphlets and Periodicals


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Flannelgraph as an Aid to Teaching and Training, The Overseas Visual Aid Centre, Tavistock Square, London, U.K.

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1 This bibliography is not related specifically to the chemical industries, but covers useful works in audio-visual aids in general as used for teaching and training.


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Institut National de Sécurité, Dix Années d'expérience sur les Affiches de Sécurité (100), 9 Avenue Montaigne, Paris 8e.

APPENDIX II

INTERNATIONAL INSTRUMENTS RELEVANT TO
SAFETY TRAINING BY AUDIO-VISUAL METHODS

A.

Extracts from the
Prevention of Industrial Accidents
Recommendation, (No. 31), 1929

Section II, Paragraph 8

Members should actively continuously encourage the adoption of measures for the promotion of safety:

(b) co-operation in the promotion of safety between the management and the workers in individual works, and of employers' and workers' organisations in the industry with each other and with the State and with other appropriate bodies by such methods and arrangements as may appear best adapted to the national conditions and aptitudes, the following methods being suggested as examples for consideration by those concerned:

(i) appointment of a safety supervisor for the works;

(ii) establishment of works safety committees.

1 The International Labour Code, 1951, Vol. I (I.L.O., Geneva, 1952) Articles 504 to 509 and 519 (d), (e) and (f).
Paragraph 9  Members should do all in their power to awaken and maintain the interest of the workers in the prevention of accidents and ensure their co-operation by means of lectures, publications, cinematograph films, visits to industrial establishments, and by such other means as they may find most appropriate.

Paragraph 10  The State should establish or promote the establishment of permanent safety exhibitions, where the best appliances, arrangements and methods for preventing accidents and promoting safety can be seen (and in the case of machinery, seen in action) and advice and information given to employers, works' officials, workers, students in the engineering and technical schools, and others.

Paragraph 11  In view of the fact that the workers, by their conduct in the factory, can and should contribute to a large extent to the success of protective measures, the State should use its influence to secure -

(a) that employers should do all in their power to improve the education of their workers in regard to the prevention of accidents; and

(b) that the workers' organisations should by using their influence with their members co-operate in this work.

Paragraph 12  In addition to measures taken in pursuance of the preceding paragraphs of this section, the State should arrange for monographs on accident causation and prevention in particular industries or branches of industry or particular processes to be prepared by the State inspection service or other competent authorities embodying the experience obtained as to the best measures for preventing accidents in the industry or process, and to be published by the State for the information of employers, works officials and workers in the industry and of employers' and workers' organisations.
Paragraph 13

1. In view of the importance of the work of education referred to in the preceding paragraph and as a foundation for such education, members should arrange for the inclusion in the curricula of the elementary schools of lessons designed to inculcate habits of carefulness, and in the curricula of continuation schools of lessons in accident prevention and first-aid.

2. Instruction in the prevention of industrial accidents should be given in vocational schools of all grades, where the importance of the subject both from the economic and moral standpoints should be impressed upon the pupils.

Section IV, Paragraph 22

The State should use its influence with accident insurance institutions and companies to co-operate in the work of accident prevention by such means as the following:

............... 

(d) the award of prizes to workmen, engineers and others who, by their inventions or ideas, contribute substantially to the avoidance of accidents;

(e) propaganda among employers and the public;

(f) advice on safety measures, contributions to safety museums and institutions for instruction in accident prevention.

B.

Extracts from the
Labour Inspection Recommendation
(No. 81), 1947†

Section II, Paragraph 4

1. Arrangements for collaboration between employers and workers for the purpose of improving conditions affecting the health and safety of the workers should be encouraged.

† The International Labour Code, op. cit., Articles 926 and 929.
2. Such arrangements might take the form of safety committees or similar bodies set up within each undertaking or establishment and including representatives of the employers and the workers.

Paragraph 7

Appropriate steps should be taken to ensure that employers and workers are given advice and instruction in labour legislation and questions of industrial hygiene and safety by such measures as -

(a) lectures, radio talks, posters, pamphlets and films explaining the provisions of labour legislation and suggesting methods for their application and measures for preventing industrial accidents and occupational diseases;

(b) health and safety exhibitions; and

(c) instruction in industrial hygiene and safety in technical schools.

C.

Extract from the Radiation Protection Convention (No. 115), 1960

Article 9

1. Appropriate warnings shall be used to indicate the presence of hazards from ionising radiations. Any information necessary in this connection shall be supplied to the workers.

2. All workers directly engaged in radiation work shall be adequately instructed, before and during such employment, in the precautions to be taken for their protection, as regards their health and safety, and the reasons therefor.

D.

Extracts from the Resolution (No. 33) concerning the
Prevention of Occupational Diseases and Poisoning in
Chemical Industries

Basic Training

4. The basic training of chemists, engineers and techni-
cians should include instruction in safety and health measures.

Plant-Level Training

8. The training of chemical workers should include
instruction in the hazards to which they may be exposed, and
special emphasis should be laid on the necessity of such pro-
tective measures as may be required. Such training can be
ensured by -

(a) instruction during the course of preliminary training;
(b) regular training programmes;
(c) pamphlets, posters, lectures and data sheets;
(d) regular instruction by competent medical or technical
persons; and
(e) warning labels affixed to containers of dangerous substances,
such warning labels to be based on the recommendations of
the I.L.O. or on the practices of the countries concerned.

Resolution (No. 33) concerning the Prevention of
Occupational Diseases and Poisoning in the Chemical Industries,