Clinical Examinations

The three employees seen in this investigation were aged 32, 30, and 37; one (Bid.) had been exposed to trichloro-ethylene for 10 years, and the other two for nine months. All three reported vague symptoms of fatigue, headaches, and dryness of the lips and mouth. Two were subject to periods of loss of appetite and of flatulence, and the operator with the longest exposure stated that he was subject to occasional feelings of vertigo. No organic defects were discovered on clinical examination. The haemoglobin values (determined by the cyan-haematin method) were somewhat low (Bid. 84%, Res. 89%, Rig. 89%); no abnormality was found in red or white cell count, differential white count, and packed cell volume.

Discussion

This study is presented to emphasize that unless adequate precautions are taken during industrial degreasing operations there may be considerable contamination of the air by trichloro-ethylene.

The primary cause of the high concentrations recorded appeared to be the use of a tank which was too small for the volume of work handled. This resulted in two major operating errors. First, not enough time was allowed for the draining of liquid trichloro-ethylene from the top of the material before withdrawal from the tank, so that quantities of liquid solvent were withdrawn; but for the presence of the draining grid, even higher concentrations would have occurred. Secondly, the rapid removal of material induced a surge of vapour, which at times was so overpowering to an observer standing near the tank. It will be noticed from Fig. 1 that the exhaust fans extract such vapour across the breathing zone of a worker at position E. The use of a mechanical hoist, limiting speed of withdrawal to 11 feet per minute or less, is strongly to be recommended (Horowitz, 1955).

When properly designed and efficiently operated, degreasers may often be used quite safely without exhaust ventilation. In circumstances where exhaust ventilation is necessary, the most efficient method of application is by means of lateral slots placed along the edges of the tank. Fig. 2 shows a typical design for such a slot exhaust system. To prevent excessive vapour loss through the exhaust system, there must be adequate free-board between the vapour line and the slots. Experience suggests that excessive loss of solvent when it occurs is due mainly to the carry-out of liquid on improperly racked work, and not to ventilation.

We are indebted to the management of the factory and the workers concerned for their ready cooperation, and to Professor G. P. Crowden and Dr. P. J. R. Challen for helpful criticism and advice.

Fig. 2 is reproduced by permission of the Division of Industrial Hygiene, New York Department of Labor.

REFERENCES


The British Occupational Hygiene Society

The first provincial meeting of the Society was held at University Hall, Liverpool, in April, 1956. During the afternoon of April 19 three papers were read by members of the staff of the General Chemicals Division, Imperial Chemical Industries Ltd.; they dealt respectively with chlorine, dust sampling and analysis, and fluorine. A film illustrating the work of the General Chemicals Division was also shown. The new President of the Society, Dr. C. G. Warner, presided over the meeting and delivered an address after dinner that evening.

On the next day members were entertained by the General Chemicals Division of Imperial Chemical Industries and conducted round the Castner-Kellner and Rocksavage works.

Presidential Address: The Pneumoconiosis Problem in Coal-mines

C. G. WARNER

Divisional Dust Suppression Scientist, National Coal Board, South Western Division

The Society is now starting its fourth year of existence, but during our brief life we have indeed achieved considerable measures of success in many directions. The reports of the conferences of the Society make interesting reading. At the inaugural meeting of the Society the then Minister of Labour and National Service, Sir Walter Monckton, in his opening address remarked:

"The prominence now being given in Government and other quarters to the development of provision for occupational health in its widest sense shows that occupational hygiene is a subject which will receive increasing attention. It is particularly opportune that the foundation of this Society should come at a time when efforts are being made to establish and develop this important service to industry. The application of knowledge of practice of many kinds is necessary to achieve these objects. The medical profession, physiologist and the psychologist must work hand in hand with the engineer, the chemist and the physicist and a vital factor must be the closest collaboration between industrial research and industrial health research."

Sir Walter continued:

"During the last decade there has been a marked increase in the interest shown in health matters by industry. But it cannot be said that the facilities for studying occupational risks to health have kept pace with the growing awareness of the importance of this subject. This Society is following this principle and I am glad to say that its membership is not limited to scientists, but includes others with interests and responsibilities in the wide field of occupational health."

Dr. Bedford, the first President of the Society, to whom is due much of the credit for its inception and constitution, reinforced Sir Walter Monckton's comments by referring to the importance of team work. Dr. Bedford, in fact, put it in these words:
“Occupational hygiene requires the employment of many skills embracing those of the various branches of medical sciences, the physical sciences, and engineering. Its research problems call for the work of highly-skilled chemists, physicists, psychologists, engineers, physiologists, and psychologists as well as that of physicians and pathologists. Most of these need to acquire either the skill, or to evoke the help, of the statistician.”

In both research and its application, occupational hygiene calls for team work—it is a joint field of specialization.

Only last April, Dr. Rogan in his presidential remarks commented on the solidarity of our Society. Although it was not then three years old, its record of progress is eminently satisfactory. Its membership is increasing, its finances are healthy, and it is represented by Dr. Bedford on the Committee instituted by Sir Walter Monckton under the title of the Industrial Health Advisory Committee.

The terms of reference of our Society, which briefly are to promote the science of occupational hygiene, seem to be bearing fruit by the practical activities that our body has been able to carry on during its brief life.

The Pneumoconiosis Problem

I feel that sufficient has been said on the general policy behind the fields of work we cover in our daily activities. I wondered, though, whether it would be of interest to the members to describe briefly the practical results which have taken place in recent years in one of our major industries. I refer to the problem of pneumoconiosis as occurring particularly in the coal-mining industry.

Work on this important subject has been going on for a number of years and when scanning through our list of membership I was very impressed to note the considerable number of our members who have contributed, or are contributing, to the subject I have named. Starting with our roll of presidents, without exception all who have taken the chair so far have been, or still are, actively engaged in the researches relevant to the air-borne dust hazard from mining. Dr. Bedford, Professor King, and Dr. Rogan are names which come to mind immediately in any discussion on the subject. Also, in that respect I may claim that I am not unconnected with the problem myself.

Among the pioneer workers in this field, the name of Dr. Amor, whom we are happy to see here with us tonight, has an important place on the roll of fame. His pioneer work into the problem of silicosis is a classic contribution to the subject. Official bodies represented actively in our membership, namely the Medical Research Council, the Safety in Mines Research Establishment, the Pneumoconiosis Research Unit of the Medical Research Council, and the National Coal Board, all have been, and still are, working in this important field.

The problem has been tackled on the broad lines of policy defined earlier, namely as a team job. In the wide-scale work which has taken place all the aspects have been represented and the collaboration between medical, scientific, and engineering branches has been very evident.

It was apparent many years ago that at least in South Wales a hazard was prevailing. Much pioneer work had been carried out in various parts of the British coalfield in the early years of this century, but it was not until the 1930s that the full impact of the problem became evident. Ultimately, in 1936, the Medical Research Council was asked to carry out the first large-scale investigation in South Wales. This was a team job and some 22 investigators covered the medical, pathological, and environmental phases of the work. From that work certain conclusions were drawn. The incidence of lung trouble was for the first time coordinated and degrees of certification put on a more rational basis. Also, there appeared to be a relation between quantity of disease and the quantity of air-borne dust that men inhaled. In that respect Dr. Bedford and myself must take our share of blame or credit for putting forward targets of dustiness for working conditions, and the figures we suggested have been the framework in the outlook as it prevails at the present time under the aegis of the Approved Conditions Scheme. At the time of our original investigation the air-borne dust concentrations which we were measuring were considerably in excess of our suggested safety figures. We had no idea how the mining engineer could achieve what we were then proposing. Even in South Wales, the focal point of the industrial hazard, there was little practical approach—I refer now to the period 1937 to 1941—to active dust suppression measures during routine mining operations. In 1942 the principle of water infusion was developed in South Wales and this method of combating the dust proved to be one of the main methods by which the engineer could reduce the make of dust. The use of this classic method of dust suppression rapidly expanded in South Wales and in practice proved to be one of the chief answers to the doctor's prayer. By this method, allied to other quickly developing suppressive measures, it was found that the engineer could achieve the very strict target levels which Dr. Bedford and I had indicated.

This chain of events, which showed that theoretical requirements could be achieved practically, was a most fortunate one and from that time the impact of preventive work against the health hazard from air-borne dust has gained increasing momentum, first in South Wales and, subsequently, through the other coalfields of the nationalized industry.

The improved position which I have indicated in the foregoing remarks did not happen as quickly as they might imply. Through the ensuing years it was an uphill fight, a fight in which the engineer was taking the brunt of the burden. It was his responsibility to achieve success and the medical investigators could only await any resultant effects of improved conditions on the health of the worker.

The uphill fight was a practical one and I took part in that fight. Having proposed, in conjunction with Dr. Bedford, these extremely difficult targets of dustlessness, I had the temerity to join the industry in South Wales in the anthracite field in an endeavour to put them into practice. Too truly was I asked to take our own medicine. However, the process turned out to be most interesting and from the period 1943 to 1947, when nationalization took place in the anthracite region, we did make considerable strides to improve working
conditions for the miner. The results of the practical work, of course, did not register in the medical statistics immediately and it is one of the difficulties of the whole of this field of work to relate inherently or directly the effect of dust, per se, on the incidence of disease. Time is showing, without doubt, that there is a broad linkage between these two factors, although the reaction period shows an apparent delay of some years.

In the pioneer work in the anthracite mines the practical application of all known suppressive measures went on apace and the reduction in air-borne concentrations through the period of years was most impressive. Quite steadily conditions were being brought down to the target levels specified and the fact that this practical hygiene result had been brought about was most comforting to all concerned in the campaign. Once again the results of team work were being illustrated and particular credit was due to the mining engineers and the colliery personnel at all levels. All cooperated to apply the knowledge made available by the research workers.

Meanwhile, in other directions the research workers I referred to in my earlier remarks were continuing their own specialized contributions to the general problem, and the many points of interest from the clinical, pathological, chemical, and other scientific studies of the dust hazard continued to receive full attention.

Nationalization of the industry only served to give impetus to the necessity of coping with the industrial problem, and in the very early days of the constitution of the National Coal Board this body stated as one of its points of policy that air-borne dust was to be considered as dangerous wherever and whenever it occurred.

Later, in 1952, the Pneumoconiosis Field Research scheme was undertaken by the National Coal Board. Twenty-five collieries were selected throughout the country and they were to be the subject of investigation for a period of at least 10 years.

All personnel employed at the collieries, above and below ground, were to be examined regularly both clinically and radiologically. Working histories of all individuals would be built up and would include details of the air-borne dust concentrations, temperature and ventilation conditions, etc., of the working environments. In this way the relation between dust and disease would be firmly established. The existing targets of permissible dustiness could be checked and safe standards of air-borne dust concentrations in British coal-mines established for all time.

The research scheme is the biggest project in practical industrial hygiene yet envisaged in the world and we hope in the near future to receive a paper by Dr. Fay, who is in charge of the environmental studies, describing the logistics of this aspect of the work.

Incidence of Pneumoconiosis.—The different levels of incidence of the disease which have prevailed between the various coalfields in Great Britain have been a source of perplexity and that position prevails to the present time.

Wales originally was the black spot and a severe rate of incidence appeared to be localized to that coalfield. But, one wonders whether incidence is not also a function of awareness of the disease. Certainly in Wales people are dust conscious and have been for many, many years. This awareness of the disease may have tended to disclose it earlier in that location, although it may yet be that the idea that there is something particularly pernicious about South Wales dust may prove to be true. It must be realized, however, that today the bulk of the numbers certified in Wales show only an early stage of dust retention and their certification at the first levels of recognized pneumoconiosis does not mean that the individuals are necessarily severely incapacitated. Far from it, they only bring to the fore the very important requirement for good industrial hygiene. Prevention is the slogan in this dust campaign and, quite rightly, the industry is now assuring itself that not only will patients with the first signs of dust retention be prevented from progressing, but also that people with a clean bill of health are exposed to only the barest risk of developing any trouble themselves.

The fight against dust has been going on longest in South Wales and we can, accordingly, from data available from that coalfield, perhaps note any potential relation between dust and disease.

Following the change in legislation in 1943, which extended the range of compensation for pneumoconiosis, the rate of certification per 1,000 men employed in operations other than South Wales rose from 0-3 in 1943 to 1-9 in 1947, while the rate for the last complete year available, namely 1954, was 5-8. In the South Western Division certification rates per 1,000 men employed, after rising to a peak of 55-6 in 1945, dropped to 30-8 in 1947. Since then the falling trend in the South Western Division has been maintained and in 1954 the rate was 9-2 per thousand men employed.

Between the South Western Division and the rest of the country we have, therefore, the diametric comparison of a falling trend in South Wales and a rising one in the rest of the country, and this comparison has persisted for a number of years.

It would be premature to draw any conclusions from these figures about the real incidence of pneumoconiosis and, except perhaps in the South Western Division, it is too early to estimate with any confidence the effectiveness of dust suppression measures. There are many factors, apart from real incidence, which affect the number of certifications—rates and conditions of compensation, standards of certification, ease of obtaining alternative employment, and awareness of the pneumoconiosis hazard. But, even if the certification and real incidence rates were identical, the figures of certifications would not at present be a measure of the effects of dust suppression.

Pneumoconiosis is a chronic disease, few cases developing in less than five to 10 years, but many taking 20 to 30 or more years to develop so that remedial measures take a long time to show results.

In the South Western Division the rapid rise in certifications between 1943 and 1945 can be accounted for by the change in legislation in 1943, leading to a rush of applications for certification. This rush could not all be dealt with by the available medical staffs until additional doctors were appointed in 1944-45. The rush
over, there has been a steady decline in the number of new certifications in the South Western Division after 1945. It is just possible that the dust suppression measures actively started in 1942 have begun to take effect. It is to be expected that anti-dust measures will be quicker to show results in the South Western Division than elsewhere.

In other divisions where the consciousness of danger from pneumoconiosis and of the procedure for obtaining compensation are in varying degrees less general than in South Wales, mineworkers have probably been slower in taking advantage of the extended field of compensation. This could account for the steady rise in certifications in other divisions without indicating any rise in the real incidence of pneumoconiosis.

Although the efficacy of dust suppression is at best only beginning to become apparent in the South Western Division, there is nothing in the figures under review to shake our faith in dust suppression as the true remedy. Moreover, despite the fact that the certification rate does not represent the real incidence of pneumoconiosis, it is sometimes the only available pointer to the areas that most urgently need attention.

During the period under review, working conditions in the pits in South Wales have altered out of all knowledge and we can say the levels of air-borne dustiness in the pits 15 years ago were up to 10 times those prevailing at the present time.

Considering the numbers of certifications in another way, South Wales in 1942 by itself had 20 times the total number of cases from the rest of the country combined. In 1945, the peak year of certification in South Wales, when 5,224 cases of pneumoconiosis were recorded in that region, the rest of the country had 597 cases, giving a ratio of 8·8 to 1. For the last year's data available, namely 1954, the ratio is now 0·26 to 1, based on numbers of cases of 927 in South Wales and 3,542 for the rest of the country respectively. This again reflects an interesting state of affairs and so far as those of us who have been concerned in the work in South Wales feel, the pendulum is definitely swinging in the right direction. Certainly new cases are not being made in the numbers as before.

Only last week in a leading South Wales newspaper the following appeared under the heading, "Battle with Pits' Death Dust is being Won":

"In 20 years' time victory over the deadliest form of pneumoconiosis will be practically won in South Wales, it is forecast.

"Government medical men, with the cooperation of the National Coal Board, are making vigorous efforts to abolish progressive massive fibrosis, the disease that blackens and distorts miners' lungs.

"A Government doctor, who is an authority on the disease, told a South Wales Echo reporter that healthier working conditions in the mines, plus the declining incidence of tuberculosis, has meant a slow but steady fall in deaths from pneumoconiosis.

"Most miners with the disease have simple pneumoconiosis, which is rarely fatal but which can be a contributory factor in death.

"One hopes in 20 years' time we will be dealing almost entirely with simple pneumoconiosis, and that in its early stages, said the doctor.

"Thirty years ago nearly all the miners who had the disease were stricken with its more deadly form, progressive massive fibrosis. It's a striking change.

"An improvement in the mines largely responsible for the change is the technique of water infusion, whereby water is injected into the coal seam."

The report ended, however, on a note of anticlimax, stating:

"But the problems of doctors never end. Now more miners complain of rheumatism."

At least that gives the research workers another hare to chase in the future.

I have not talked to you in terms of tons per man, units per ton, or presented a series of tables forming a statistical report. In this address I have tried to give a practical example which substantiates the ideals of the Society, namely that team work to promote the science of occupational hygiene is the way to resolve an industrial health problem.