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The Value of Industrial Hygiene*

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HYGIENE is a branch of medical science that relates to the preservation of health. This definition outlines the scope to which our thinking should be carried when we evaluate the effects that may result from the coördination of the many sciences that are contributing to the well-being of our industrial population.

Since the main objective is prevention of illness from the occupational environment, the medical profession must accept the responsibility and be the guiding spirit in realizing this objective.

The effects of any agent on the human body must of necessity be studied with regard to the normal physiological actions as well as the abnormal. This dual concept is fundamental in medical science. While the medical phase may play a dominant part in our evaluation of the worth of industrial hygiene there are three other distinct elements: engineering, chemistry, and physics, all of which must be closely correlated if we are to attain our objective.

Industrial management has at times overlooked the value of controlling industrial environment, not only from a purely economic basis but also from the point of view of the psychological reactions of the individual worker. This fact has been emphasized more recently by the increased interest shown in the matter by our organized labor groups which were keenly aware of the psychological factor in spurring the production reached during the period of World War II.

Perhaps the greatest advance made during the recent war years has been the attempt to analyze individual jobs in respect to the physical and mental requirements. This job analysis made it necessary not only to study the physical effort necessary for the job but also the chemistry of the materials involved in the job. Furthermore, the engineering aspects of the machine and its functional operation in its relation to the individual who has the responsibility of operation has elicited extensive study.

Much still remains to be done in this matter of relation of the worker to the job. It definitely is a phase of industrial hygiene in its broadest conception.

Since 1915 much has been accomplished by our efforts in accident prevention in our industrial plants. These efforts were based on the theory that all accidents can be attributed to mechanical failure. The human element, which perhaps is a factor of failure in 80 per cent of our industrial accidents, has been entirely neglected. In view of the broadening vision that industrial well-being is an asset in any accident prevention program to render it of real value, there must of necessity be an equal interest in and a study of the human element in its relation to the mechanical causes of all industrial injuries. This requires the close coördination of industrial hygiene personnel and those responsible for safe mechanical working conditions. With such an organization we will enter a new era in our efforts to reduce the enormous toll of accidents in industry. According to

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statistics of the National Safety Council for the year 1945 there were 16,000 fatalities, 80,000 permanent disabilities, and 104,000 temporary disabilities charged to industry. This constituted a man-day loss to industrial production of 46,000,000 days—a loss which cannot be estimated in monetary value.

The working population in the United States now numbers approximately 60,000,000 persons, and out of this group there are probably 15,000,000 persons working in those industries which use potentially hazardous materials or processes. In these selected industries, perhaps about one-third of the total persons employed are exposed to some type of material or process which may involve a potential health hazard. These 5,000,000 exposed persons present a very real problem to industry throughout the nation, and the value of industrial hygiene is being demonstrated by the preservation of the health of these people.

During the war years a new viewpoint was developed toward industrial hygiene activities. Many industries suddenly were faced with the problem of protecting the health of thousands of men working with hazardous materials or processes. There was an instantaneous demand for trained personnel, and this demand was filled by drawing persons from related fields of activity in medicine, engineering, chemistry and physics.

One of the outstanding accomplishments in the field of control of occupational diseases during the war period was the work of McConnell, Flinn, and Brandt in government owned ordnance explosive plants. In the 968,000 man-years of operations (among 309,000 operating employees in 101 plants) there were only 28 fatalities because of occupational disease—22 from trinitrotoluene, 3 from nitrous oxide, 2 from carbon tetrachloride, and 1 from ethyl ether—a rate of less than 3 fatalities per 100,000 workers per year. Despite the magnitude of explosives production, the total of 22 fatalities due to TNT reported here is but a small fraction of the 475 fatalities reported from TNT and related compounds during relatively limited production in World War I. The Army has a commendable record. It established this record even though there was no industrial medical program in the Army in 1941, by using civilian physicians already trained in this field. I am glad to see such results published.

Many industrial organizations have equally commendable records and they too should be published. In fact, I have been amazed at the dearth of such material in our journals. We can be proud of our records, so why not set them down for all to see? Our story in this regard which we all hope to see published soon and which again will show the need for and the value of industrial hygiene is that of the production of the atomic bomb. I am sure all of us, now that part of the story is known, can imagine the magnitude of the task which confronted the physicians, engineers, and physicists at plants engaged in this work. We do not know the whole story as yet, but at least we know industrial hygiene stood the test and was a great factor in the success of this project.

The atomic bomb was a dramatic unveiling of the tremendous power and energy which now can be made available for the benefit of man. It has opened new fields, not only for the possibilities in the generation of power, but it will make available many of the ninety-six known elements in radioactive form. The availability of these radioactive elements will result in many important applications. Perhaps one of the most important applications is their use as tracer elements. Another definite possibility is in their therapeutic application.

The smashing of atoms produces, among other things, tremendous radia-

tion; and the usefulness of the various radioactive elements will be determined to a considerable extent by the emanations which they give off. A challenge is presented to us in this preventive field, and the successful utilization of atomic energy will depend upon the elimination of health hazards associated with the variety of radiations which occur in their use. Electrons, neutrons, alpha particles, gamma rays and other radiations will be included in the field of industrial hygiene as lead and benzol have in the past.

Among examinations of noteworthy effort were those made on workers engaged in the manufacture of insecticide bombs for the armed services. Over half of the bombs produced used a formula containing pyrethrum, sesame oil and freon. Since none of these materials is very toxic to human beings, there was no particular problem of health protection involved. After DDT had been developed and sufficient information was available to indicate that it could be used with safety by personnel of the armed services, a potential hazard was created by continuous eight-hour-per-day exposure among persons performing the various manufacturing operations, and this had to be given serious consideration.

The problem involved not only the possibility of breathing the fine mist produced by the aerosol from the Bug Bombs, but also the possible significance of absorbing DDT through the skin. This hazard was recognized prior to the actual use of this material and, by close coöperation between our industrial hygiene engineers, manufacturing personnel, process and layout engineers, a complete new installation was made with protective measures built in as a part of the original layout of the equipment. Where it was not practical to eliminate the hazard by suitable design and layout of equipment, the hazard was controlled by use of personal protective equipment and sanitary measures. Adequate pre-placement and periodic physical examinations were made on all employees involved in this operation. Several months after production was started, certain laboratory findings indicated a need for slightly better control, and such control was established. The production of Bug Bombs has continued into the post-war period, and there have been no cases of illness of occupational disease as a result of these operations.

Another of the high production war items was radar equipment. The manufacture, testing, and operation of the various types of radar equipment involved numerous exposures to high frequency radiation. This type of radiation had been relatively unknown except in the laboratory, and of course there were many suppositions that this radiation might be harmful to human bodies. Some of the common illnesses to which average persons are subject were quickly associated in the workers' minds with this new radiation. Extensive tests and examinations have indicated, however, that these radiations have no harmful effect on persons other than the slight amount of heating which may occur. Usually this heating is negligible and no particular hazard has been demonstrated.

Recently a completely new concept has been established which unites the growing of food, its processing, packaging, and distribution. This close coordination of all these activities at one location has been referred to as "agro-industry." Agriculture and industry have been transmuted into a single integrative activity. This concept of agro-industry is extremely large. It is in fact one of those grand ideas that stagger the imagination with their scope, complexity, and implication. Agro-industry has been applied to the cultivation of cane and root crops, and the manufacture of starch and sugar in

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the Everglades of Florida. This concept of agro-industry opens another new field in industrial hygiene.

The impetus given to the study and control of industrial health hazards during the past few years has resulted in a fuller appreciation of the value of industrial hygiene. It is a broadening field and it is now utilizing the services of hundreds of specially trained personnel. The field of industrial hygiene is continuing to draw talent from related professions and it is uniting physicians, chemists, engineers, and physicists in this broad endeavor of safeguarding the health of our industrial workers.

Those of us who are devoting full time to industry and attending the managers' meetings to insure an adequate budget for the current and following years have had it only too thoroughly impressed upon us that the era of "cost plus" is over; things are now different; competition in the price of production is again becoming the paramount issue, and curtailment of expense will be the keynote in every possible phase. This is quite a different story from the one we heard during the war period.

This brings us then to what I feel is an important phase of this discussion concerning the value of industrial hygiene. What are we as physicians doing to preserve the gains made during the war? What have we learned that is going to help us to continue to achieve greater stature among industrialists, the employees, and, last but not least, our own medical profession? It may be presumptuous to suggest the means by which an employer can evaluate his preventive hygiene service. Our experience in large and small plants, however, indicates that management is anxious to have a yardstick by which it can measure the effectiveness of all services. This applies in particular to those who are genuinely interested in the welfare of their workers.

There are tangible profits which may be shown, such as a reduction in absenteeism, a diminution in the number of grievances presented by individual employees relative to working conditions, the reduction of occupational disease claims, the reduction of actual compensation costs through a reduction in accident frequency, and a reduction in labor turnover. The intangible benefits such as the improvement in general health as the result of periodic physical examinations, and an intensive program of health education can well be included in the estimate of the value of an industrial hygiene program in industry. All of this brings to our attention the necessity of an annual inventory of our work which can be presented to management only if adequate records are kept, and this factor too is of the utmost importance for future programs in the field of industrial health.

In considering the future value of industrial hygiene, one cannot neglect the problems of education. Although limited training now is available in various universities to those who wish to enter the field, there still is need for the establishment of complete courses which will develop workers for the field of industrial hygiene.

We all are familiar with the studies made a number of years ago which indicated that the mortality and morbidity rates among the industrial population were greater than those of the general population. The value of industrial hygiene will be measured in the future by a reduction of the mortality and morbidity rates of industrial workers to the point where they may even be lower than those of the general population.

It is not possible to treat this subject wholly in the time allotted or by a single presentation, but even a brief consideration of our topic suggests the existing challenge to us physicians, engineers, chemists, and physicists upon whom falls the responsibility of safe-

guarding the health of our industrial workers. And, further, it suggests a challenge which presents a new horizon and new frontiers in the field of preventive medicine in its broad aspects. If we meet this challenge we shall contribute greatly to the continuance of our American Way of Life.

International Tropical Medicine Congress to Meet in Washington, May, 1948

Wilbur A. Sawyer, M.D., Executive Secretary of the State Department's Division of International Congresses, announces the first American meeting of the International Congress of Tropical Medicine and the International Congress on Malaria in Washington next May. The Department of State will sponsor the meeting with the coöperation of five governmental agencies and fifteen scientific societies including the American Public Health Association.

These organizations all have representatives on an Organizing Committee appointed by the Secretary of State with Thomas Parran, M.D., as Chairman, George K. Strode, M.D., and Clarke L. Willard as Vice Chairmen, Rolla E. Dyer, M.D., as Program Director, Wilbur A. Sawyer, M.D., as Executive Secretary, and William L. Breese as Secretary. The representative of the A.P.H.A. on the Organizing Committee is Henry E. Meleney, M.D., who is also Convener of Section XI, Public Health. The scientific meetings will be held in twelve sections: I, Research and Teaching Institutes; II, Tropical Climatology and Physiology; III, Bacterial and Spirochetal Diseases; IV, Virus and Rickettsial Diseases; V, Malaria; VI, Helminthic Diseases; VII, Protozoan Diseases; VIII, Nutritional Diseases in the Tropics; IX, Tropical Dermatology and Mycology; X, Tropical Veterinary Medicine; XI, Public Health; XII, Medical and Veterinary Entomology. There will also be scientific and commercial exhibits and a program of motion pictures on subjects related to tropical medicine. In addition, there will be visits to the laboratories of the Department of Agriculture in Beltsville, to the National Institute of Health in Bethesda, and to other scientific institutions in and around Washington.

Physicians, scientists, and other professional persons qualified in tropical medicine will be enrolled as Members of the Congresses. Those interested are advised to write to the Executive Secretary, Fourth International Congresses on Tropical Medicine and Malaria, Department of State, Washington 25, D. C., for a copy of the Preliminary Announcement with the Advance Registration and Hotel Reservation Form.