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MEDICAL RESEARCH PROGRAM IN INDUSTRY

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THERE EXIST numerous problems of medicine in industry which need further research effort. For instance, how can the cardiac be used in industry, effectively, yet safely? What is the effect of noise on employees, and how should this be handled? What are the effects of air pollution on health and well-being? These are but some of the medical problems of industry which need research for their solution.

Our own interest in organized medical research began about 1945, when several of the executives of our company began to wonder what the effects of the increasing use of additives in petroleum products might have upon the users of those products. Prior to that time, ROY BONSIB had reviewed potential toxicity hazards and written recommendations for their control based principally on literature searches.

In order to insure that the Division would obtain the proper perspective, company-wide, on potential toxic hazards, a Toxicity Subcommittee was created (Fig. 1).

To this committee our Division serves as advisor. Potential problems are referred to the committee by the various groups represented, or by any other person or group within the company. From these groups the Medical Research Division is familiarized with the contemplated use of the compound under consideration, the volume of business contemplated and other technical facts which will put the potential problem in its proper perspective. New uses for old products can be reviewed from a toxicological standpoint during or before this use.

Perhaps one of the most dramatic cases of the effect of additives is the well known example of tetraethyl lead. In its developmental stages, it was found that this compound had serious effects upon the health of workers. Naturally, therefore, the question immediately arose whether or not in the amounts present in gasoline it would have an effect on the health of gas station attendants, automobile mechanics, automobile operators, and, from breathing the lead in automobile exhaust, on the general public. As a result of a brilliant piece of research by DR. ROBERT KEHOE and his associates, the answers to these questions were obtained and we all today use tetraethyl lead without worry. This does not make it any less toxic today than it was in 1920.

The Division had its origins in one individual who served as advisor to this committee. As the number and scope of the problems referred to this individual increased, additional personnel have been added, until today the organizational set-up of the Division is as indicated in Fig. 2.

Once a problem has been referred to the Toxicity Subcommittee, the Medical Research Division begins to accumulate the information which will make it possible to evaluate any potential health hazards which may be associated with this use. Our first source of information, naturally, is the literature, to determine whether there is any published toxicological work. If we are unable to find the required information in the literature, we next turn to others who may have sources of information not available to us or in the literature. These are our

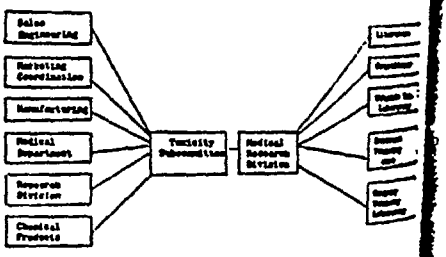

Fig. 1.

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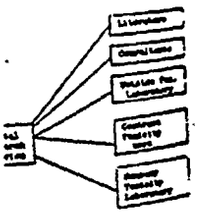

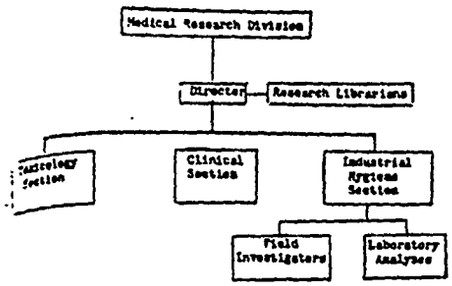

Fig. 2.

friends and acquaintances in other industries, the universities, or government who may be able to furnish us the desired information. Finally we consult other toxicity laboratories, in industry or elsewhere, who may be able to provide us the toxicity information we need.

As a result of this preliminary ground work, we are able to evaluate what is known, and what additional information will be needed, and plan the toxicity studies which are indicated. These studies may be done in our own laboratories if the facilities are available, but if not, then they are performed under contract by one or another toxicity laboratory. It is very important that the toxicity laboratory chosen be well versed in toxicological techniques, otherwise completely extraneous, misleading, or irrelevant results may be obtained. The simple fact that a compound may or may not be toxic, by itself is of very little help in attempting to evaluate the hazards from its use. This was illustrated by the case of tetraethyl lead, the toxicity of which was not altered by DR. KEHOE'S work but the hazards of handling were definitely eliminated by his work. In addition it is essential to know where it is to be used, how it will come in contact with people, how often and for how long contact will continue, etc.

Once the toxicity information has been developed, either from the literature or from actual toxicity laboratory investigations and it appears that a material may present a potential health problem, then the Industrial Hygiene Section takes over and studies the possible exposures and methods of controlling them. Is the exposure from breathing the material, from contact with the skin, or from ingestion, or from a combination of these? How often does exposure occur? How long does each exposure last? What level of exposure occurs? What are the work habits of the men and how can they be altered so as to minimize exposure? What are the engineering features of the equipment and how can they be altered or ventilation improved to reduce exposure? Can non-toxic chemicals be substituted for toxic ones and still accomplish the same operating effect? Will protective equipment provide the necessary protection where exposure cannot otherwise be avoided, and if so, what protective equipment should be provided and where and how should it be used? This is the type of question which can be answered by the Industrial Hygiene Section after careful study, collection of samples where indicated, and analysis of samples after collection. Let it be emphasized at this point that the techniques of industrial hygiene are not unique in and of themselves, but frequently the collecting methods are quite specific, and the amounts of material being analyzed are quite small, so that special analytical techniques must be used. Therefore, it is essential that the industrial hygienist be fully familiar with the limitations and pitfalls of his techniques. This implies that he must have special training or long periods of supervised instruction in these techniques before he can be considered competent to interpret the significance of his findings. It often occurs that a safety supervisor is suddenly made responsible for industrial hygiene without any period of special training or previous experience. This is unfair to the safety supervisor, and in most cases would lead to a false sense of security. These remarks are not intended in any way as a criticism of safety supervisors, who have done an extremely wonderful job in a field in which the training and background must necessarily be different from those of the industrial hygienist. It is intended only to caution against expecting from the safety department personnel a service which they are not trained to provide.

When the Industrial Hygiene Section has completed its studies and developed the facts about exposure, then the Clinical Section swings into action. From the facts developed by the toxicologist and the industrial hygienist, an attempt is made to evaluate the

potential effects on man of exposures at levels determined by the industrial hygienists to compounds of the toxicity determined by the toxicologist. Will men be affected by these exposures? If so, how can the effect be measured? Are preplacement examinations necessary to exclude those who may be unusually susceptible? Are periodic examinations necessary, and if so, how frequently should they be done and what should the examination consist of? Should men be removed from the job if certain changes are observed and at what stage should they be removed? Are the controls recommended by the industrial hygienist adequate, or are more elaborate controls necessary? If an accident occurs, what is the best method of treatment, are there any antidotes, what first aid measures should be developed? These are the questions that must be answered by the Clinical Section. All of these answers should be available before any new process or the use of any new chemical progresses beyond the pilot plant stage. It has been found that if we develop this information for the protection of our own employees, then we are in a position to answer the questions which will be raised by the consumers of our products, and to assist them in the proper handling of our products without danger to their own employees.

In addition to evaluating the hazards from the use of new chemicals or new processes, our Division is also concerned with the development of new concepts in each of our three lines of endeavor. As an example, the Industrial Hygiene Section is performing research on new methods of sampling, new analytical methods, and improvement of older methods. Recently an extensive study of skin contact was undertaken in conjunction with the Medical Department of the Esso Standard Oil Company. The techniques developed were somewhat unusual and should be applicable not only within our own industry, but also in other industries with skin contact problems. A study of protective clothing is also under way to try to develop a suit which would provide protection, yet be cool enough that it could be worn in hot climates.

Our Toxicology Section is embarking now on a program of fundamental research on the effect of hydrocarbons on various metabolic processes. Are body enzyme systems affected by aliphatic or aromatic hydrocarbons, and if so, how? Do these changes in body enzymes occur before body cells are visibly damaged? If so, these methods lend themselves to application by the physician in studying the effects of different exposures before irreparable damage has been done? It is a fact that parathion is a very toxic material which will cause convulsions in men overexposed to it. However, long before convulsions appear, it will depress the blood cholinesterase. As a result, a practical field test has been developed to detect parathion exposures at a time when the only detectable change is in the blood cholinesterase. At this stage the blood cholinesterase will restore itself to normal, without having subjected the exposed person to any danger from convulsions. Are similar sensitive enzyme reactions occurring in benzene and other aromatic hydrocarbon exposures? Today the only measure of benzene toxicity is its effect on the bone marrow. When this occurs, irreparable damage has often already been done.

Because industry is always developing new processes or new products, or finding new uses for old products, we find that there are never lacking in work projects to be performed. We have found it advantageous to be set up organizationally in the Standard Oil Development Company, the central research affiliate of the Standard Oil Company (N.J.). This permits us to learn of new ideas as they are developed, and to work right along with the chemists and engineers as their efforts proceed from mental processes to laboratory bench work, to small pilot plant, to large pilot plant, to engineering design for full scale production units. Our efforts quite naturally vary with the stage of development, but our ultimate objectives are to identify medical or hygiene problems arising from the manufacture or use of various petroleum and chemical products as they affect employees, customers, the general public, and to investigate steps to be taken to minimize or eliminate these problems. Our motto is that no chemical is too toxic to be used, provided it is understood how to use it safely. Our program is designed to develop information essential to a proper understanding of the necessary precautions for the safe handling from the health standpoint of any chemical or