

MANUAL OF INDUSTRIAL HYGIENE

AND
MEDICAL SERVICE IN WAR INDUSTRIES

*Issued under the Auspices of the Committee on
Industrial Medicine of the Division of Med-
ical Sciences of the National Research Council*

PREPARED BY THE DIVISION OF INDUSTRIAL
HYGIENE, NATIONAL INSTITUTE OF HEALTH,
UNITED STATES PUBLIC HEALTH SERVICE

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Editor

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**INDUSTRIAL HYGIENE
AND MEDICAL SERVICE
IN WAR INDUSTRIES**

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FOREWORD

THE urgent demand for doctors and engineers in the military forces has served to deplete industry's pool of experienced industrial physicians, industrial engineers, and industrial hygienists. This book is therefore intended not only as a source of information for industrial physicians who must meet the changed conditions in industries converted to war purposes, but as a guide for those who patriotically volunteer to take the places of industrial physicians who have gone into the service. I believe the book is sufficiently complete to accomplish these ends.

There are about 17 million workers in the war industries, and their number is steadily increasing. Consequently, they comprise a substantial section of the population, whose health is of immeasurable importance to the war effort. For the protection of their health and for the reduction of sickness absenteeism, which interferes so greatly with production, these workers depend upon an equally substantial proportion of the available civilian physicians of the United States.

It is hoped that this book will obtain a wide reading among all who have to deal in any way whatever with the health problems of war workers, and that it will arouse an awareness among them of the opportunities for usefulness in the production of war material.

In behalf of the Subcommittee on Industrial Health and Medicine, I wish to thank the Health and Medical Committee for making this important book possible; and also, Dr. James G. Townsend, Chief of Division of Industrial Hygiene, National Institute of Health, United States Public Health Service; the members of his staff; and the other contributors, for their excellent work.

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PREFACE

THE unprecedented growth of industry and the rapid development of industrial facilities to meet the needs of the Nation at war demand a corresponding increase in industrial health practice. This means the organization of programs and the adoption of policies which, in a large measure, should be uniform in structure.

Although the literature is abundant in its coverage for the many variables in medical and engineering industrial hygiene, there was not before available a book small enough to give compact knowledge and yet large enough to cover the entire subject. With this realization, the Committee on Industrial Medicine, Division of Medical Sciences, National Research Council, whose Chairman is Dr. Clarence D. Selby, recommended through the Health and Medical Committee that the Administrator of the Federal Security Agency instruct the Division of Industrial Hygiene, National Institute of Health, United States Public Health Service, through its Surgeon General, to prepare such a text. This we have done, with the knowledge that some may think too much emphasis has been given to certain subjects and not enough to others, and that still other items, important in the viewpoint of some authorities, have not been included. Due consideration has been given this, and much editing has been necessary to emphasize the *salient* points based on the Division's many years of experience in the industrial hygiene field, and yet keep the book within convenient size for reference.

Further detailed information may be obtained by writing to either this Division or, if one exists, to the industrial hygiene office of the State Government.

Finally, we should like to express our appreciation to those who reviewed a number of the chapters.

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PART I

ORGANIZATION AND OPERATION OF FACILITIES

CHAPTER 1

WAR'S INFLUENCE ON INDUSTRIAL HYGIENE

J. J. Bloomfield, B.S.Eng.

IN an address before the National Conference of Governmental Industrial Hygienists,¹ the Federal Security Administrator and Chairman of the Manpower Commission stated that the wartime task of industrial medicine was second in importance only to the responsibility of military medicine. That task, he said, is to keep every worker on the job by the prevention of sickness and accidents; and if disability is incurred, to restore the worker to the job "as quickly as science, skill and nature permit."

War, however, has brought about certain conditions which greatly complicate the problems of industrial health. Although specific difficulties are as varied as the enormously diversified war industries themselves, the national problem presents four broad conditions which exist, to a greater or less extent, in all of the 48 States and in the possessions. These are: first, health problems arising in the community environment; second, the physical composition of the war-labor force as compared to the peacetime labor supply; third, hazards which are found in the working environment; and fourth, the shortage of trained personnel in the various professions concerned with health conservation in industry.

THE COMMUNITY ENVIRONMENT AND THE WORKER

The industrial hygienist is well aware that his efforts to ensure a safe and healthful working environment are often nullified by unfavorable conditions in the community. The rapid expansion of war industries has had an incalculable effect upon the provision of adequate community service in many parts of the country. For example, the war contracts allotted to date have been very unevenly distributed geographically. At one time, 73

per cent of the war contracts were allotted in 20 industrial centers containing 22 per cent of the total population. As a result of war production, there is in motion a vast transmigration of workers and their families. New war plants have been built in rural areas with little thought to the provision of even rudimentary facilities such as adequate housing, safe water, and sewage disposal.

Under the "Community Facilities Act," Congress has appropriated some \$300,000,000 for the construction of schools, hospitals, water supply, sewage disposal, and other public works in war areas. This sum was about \$50,000,000 short of the estimated cost of essential construction at the time of the attack on Pearl Harbor. Construction, however, has been hampered owing to the difficulty of obtaining critical materials.

With the crowding in factories, crowding in homes, crowding in transportation facilities, war industries are under constant threat of outbreaks of contagious disease among employees, which would seriously disrupt production. Every necessary precaution must be taken to avoid such an occurrence. The strengthening of general public health services in the community thus becomes an essential part of the industrial hygiene program. The industrial physician should be able to rely upon his local health agency to fight this rear-guard action in support of his front-line attack against time-loss in our war production drive. To help the States hold the line against preventable disease, the United States Public Health Service, under emergency appropriations by Congress, has recruited and trained 800 professional workers—physicians, engineers, nurses, technicians, and others—and assigned them to duty, under the direct supervision of State health departments, to critical war areas.

Thus, although actual performance still falls far short of immediate needs, a good beginning has been made in the provision of minimum public health facilities in war areas. Further improvement must come, in large part, through a more realistic facing of the problem by the States and communities involved.

Crowding, poor housing, lack of sufficient medical facilities, schools, recreation and other welfare services all combine seriously to threaten health and to disrupt normal family life. Add to these the mental strain caused by war worries, and we have a situation under which thousands of war workers are now living which is certainly not conducive to good morale and all-out production.

The disruption of community facilities, then, is one of the many influences of war upon industrial medicine; it is perhaps the first one to be felt in the industrial physician's practice, and equally one of the last to be recognized. Industrial medicine can no longer confine itself to emergency treatment and the diagnosis of occupational diseases. True, there is a bigger job to be done in the plant itself—that is, a job of prevention. But even this cannot be accomplished without a prompt and responsible recognition of the influence of living conditions upon absenteeism and industrial disability. This is "total war"; half-way measures, half-way acceptance of responsibility; and a half-way concept of the job will not win. In dealing with the worker, we must adopt a concept of the "total man" if we are to keep him on the job and enable him to contribute to the common cause—his utmost in high morale, vigor, and efficiency.

COMPOSITION OF THE WAR LABOR FORCE

The Manpower Need

The War Manpower Commission has estimated that at the end of 1942 about 18 million persons were at work in armament, shipbuilding, munitions, and construction industries. By the close of 1943, those figures will have increased to 22 million workers. If we add a reasonable number of employees in such essential industries as transportation, public utilities, food processing, and agriculture, the total war-labor force by the end of 1943 will be 30 million—more men and women employed in industry than ever before in our history.

Although the most conservative estimates indicate that the United States is statistically capable of meeting this demand for manpower, the feat of actually supplying manpower as needed is by no means simple. The induction of men into the armed services through the quota system in service commands, the geographical location of war industries, uneven distribution of war contracts, priorities, and conversion are all creating local and regional shortages of labor.

Employment of Women

The increased employment of women will be one of the most notable changes in industry as a result of the war. Of the 50 million women, 14 years of age and over, who were listed in the 1940 Census, nearly 16 million are already at work. The remain-

ing 34 million will probably comprise the Nation's principal labor reserve; not more than 13 million of these will actually be available to industry, however. Age requirements, the need for farm labor, maintenance of homes, and the voluntary services will serve to limit the use of this potential supply.

The War Production Board is encouraging the employment of women on the grounds that "employing a woman for any job that she can do or can learn to do will release a man either for work not suitable for women or for active armed service." According to the Women's Bureau of the United States Department of Labor,² women are already employed on lathes, automatic gear cutting or shaping machines, metal turning, core making, shell loading, certain tire making operations, and certain types of general labor work. Women have been found especially employable in our expanding aircraft production program, in instrument making, and in both small arms and artillery ammunition work.

In one American plane plant, women are now handling 38 different jobs, from milling machine and turret lathe operator to sewing machine operator and parts stamper. In the entire plant there are only nine jobs to which women definitely are not suited because of physical requirements, and five for which the required training is too long to warrant introducing women.

How does this unprecedented infiltration of women workers into occupations formerly open only to men affect the work of the industrial physician? The morbidity rates from various non-industrial diseases are higher among women than among men. For example, analysis of statistics reported to the Division of Industrial Hygiene, National Institute of Health, on 8-day or longer absences in certain industries, shows that sickness incidence rates for women are about 60 per cent higher than for male workers.³ The highest tuberculosis death rates are recorded among women in the employable age group, 15-24 years. The employment of women, especially in the heavy industries, presents numerous problems which industrial medicine must meet if war production is to use our womanpower to the best advantage.

Salvaging the Handicapped

To win the war, we must use *all* of our manpower. As a nation we have accepted the fact that until the war is over, there

will be no "business as usual" for any of us. Many peacetime standards will have to be revised. We are salvaging rubber, aluminum, copper, scrap iron, tin, so that we can meet shortages in strategic materials. Likewise, we must salvage those workers who are handicapped by both major and minor disabilities. Our physical standards for employment have been rigid and arbitrary, and in many cases, unnecessarily high. These standards are still being applied in war plants, and valuable workers with physical defects are being turned away.

The War Manpower Commission has already called upon management to review and adjust these standards to immediate needs. The industrial physician has a definite responsibility in influencing and guiding decisions with respect to the employment of handicapped persons. We have said for many years that the pre-employment examination *should* be used as a mechanism for the proper placement of workers. War has brought the demand that the pre-employment examination *must* be used as a tool to place *all* workers—including the physically handicapped—in jobs best suited to their capacities, jobs in which performance will be at required efficiency without unusual hazard to the worker or his associates.

The rehabilitation clinics, with follow-up, provision of orthopedic appliances and training, and employment, offer a possible mechanism for prompt adoption of a more liberal policy with respect to the utilization of handicapped workers. The United States Public Health Service, the U. S. Employment Service, and the Office of Education stand ready to assist management, employment departments, and industrial physicians in war plants in the formulation of standards, the referral of handicapped persons for employment and in the training of such workers for suitable jobs.

Detailed knowledge of the jobs in a given plant should be a part of the industrial physician's equipment—not merely knowledge of the number of vacancies, but of the actual operations, the potential exposures, and the required physical capacity for each operation. This kind of knowledge is not to be acquired by reading reports, but by personal study of the problem in the shop. Knowledge of the job combined with the physician's knowledge of the human organism will make it possible to salvage many thousands of physically handicapped workers for participation in the war production drive.