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Hypertension in Workers over Forty Years of Age

—A Preliminary Report—

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HE blood pressure in workers 40 years of age and over has not been studied sufficiently. Although it s been recognized for many years that the blood essure rises steadily with age, only a relatively small mber of blood pressure readings in the older age oups has been available. Many blood pressures of soldiers and workmen have been published, e of these groups generally ranged between 0 years. These studies have been cited in a evious paper.[1] One of the largest groups was that udied by Britten and Thompson[2] who found that in 38 male workers over 40 the systolic pressure was 0 mm. or more in 16% in the decade 40-49 years, 3.6% in the decade 50-59 years, and 51.2% in those 0 years or over.

In the previous paper referred to above[1] we plotted he incidence of hypertension in the general population s calculated from 42,000 published figures. It was hown that the incidence of hypertension (150/90 or ore) rose from 5% at the age of 25 to 45% above 5 years. Although the number of cases in the age roup 40 years or over was relatively small, we intimated that hypertension in the general population was ore frequent than was ordinarily appreciated. This as emphasized by Robinson and Bruger[3] who concluded from a study of approximately 4600 persons 40 ears or over that about 40% of the adult population s prehypertensive or hypertensive. In this report and n others in preparation[4] we are presenting an analysis f the blood pressure in the general population 40 years of age or over as based on readings obtained in workrs in industry, hospital patients, and inmates of bomes or the aged.

Knowledge of the true incidence of hypertension in he general population is of fundamental importance n the study of arteriosclerosis, hypertension and the ing process. Its importance is enhanced when one rs that the nation's population over 40 is g yearly by the millions. Dublin[5] has calcuat, in the year 1940, 6.8% of the population s 65 years of age or over, comprising nearly 0,000,000 persons, and 26.5% was 45 years of age r over. He estimates that in 1980 the corresponding ercentages would be 14.4 and 40.37, or 22,000,000 perons over 65 years of age and about 61,500,000 persons 45 years of age or over. Stieglitz[6], too, has emphasized the same facts, i.e., that 40% of population in 1980 will be over the age of 45. The interest of the clinician and the physician in industry in the incidence of hypertension in people over 40 lies further in the fact that in the present war emergency many more men and women of the older age groups will be employed than ever before, whereas hitherto they were probably discriminated against to some degree.

Material

WITH the whole hearted cooperation of DR. R. D. MUDD, Medical Director, Chevrolet-Grey Iron Foundry, Saginaw, Michigan, a division of General Motors, of DR. G. H. GEHRMANN, Medical Director, E. I. Du Pont de Nemours & Co., Wilmington, Delaware, and of DR. EDWARD MCSWEENEY, Medical Director, New York Telephone Company, DR. MICHAEL LAKE, Medical Director, R. H. Macy & Co., New York, and DR. LOUIS HAUSMAN, of B. Altman Co., New York, we obtained blood pressure readings in 5453 workers, 40 years of age and over, comprising 3665 men and 1788 women.

In all cases the blood pressures were taken by physicians by the auscultatory method. The sudden diminution in intensity of the sounds (fourth phase) was taken as the diastolic pressure in about one-third to one-half the cases, while in the remaining the total disappearance of sound (fifth phase) was considered as the diastolic level. Since the majority of opinion favors the sudden loss of sound intensity as the correct diastolic blood pressure it will be seen that our diastolic figures are on the conservative side, i.e., in many cases they are lower than they should be. The medical directors took pains to reassure and calm the patient, and the average or final resting blood pressures were recorded. The blood pressure readings were those of applicants for jobs, those obtained during periodical examinations every half to two years, and in the case of the New York Telephone Company also at times of enforced retirement, i.e., age 65 for men and 55 for women. In this company, as probably in the others, any active employee or retired employee could have a voluntary examination any time he wanted.

In general the companies were liberal in their acceptance of employees, taking even young workers with

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From the Mount Sinai Hospital, New York City.

[illegible] when it is known that the workers are changed every six weeks, the job being part of a rotating course given to student employees in the plant.

There are, of course, many related subjects which could profitably be discussed in a paper of this type, such as the effects on the skin of washroom soap; of [illegible] compounds; of the action of oils; as well as the [illegible] of many solvents on the skin—but time forbids their inclusion. It can be said that the control measures discussed here, coupled with this company's established policy of good housekeeping and general plant cleanliness, have lowered our dermatitis cases to less than 1½ cases per 1,000 men a month.

SUMMARY: As uncleanliness of the skin is the chief predisposing cause of industrial dermatitis, the employer should provide adequate facilities for the care of [illegible] employees' personal hygiene while at work. This will include sanitary washrooms equipped with hot and [illegible] running water, a non-irritating soap, towels, and under certain conditions, bath showers.

Another prominent measure is the elimination of [illegible] materials from contact with the worker by [illegible] or partially enclosing the operation so that [illegible], fumes, vapors, or dusts are prevented from reaching the worker.

[illegible] important factor in the *prevention* of skin infections is the use of protective clothing, provided this type of equipment is kept in good repair, is cleaned and disinfected periodically after return to stock when used [illegible] worker before being reissued to another employee. [illegible] types of disinfecting solutions are mentioned—a [illegible] solution of hypochlorite for rubber articles, and [illegible] more delicate fabrics, a soap solution containing a [illegible] or other disinfectant.

[illegible] last important control measure is the use of protective skin creams. These creams form a "protective barrier film" between the skin and industrial poisons or dirt and grime likely to cause the dermatitis. [illegible] products should be non-irritating, and should, generally speaking, be insoluble or nearly so in the [illegible] against which they are to protect. They should [illegible] easily removed at the end of the work period with [illegible] and warm water. At least two or three standard [illegible] are necessary. Occasionally a particular exposure will require a special formulation.

[illegible] control measures discussed here, together with [illegible] company's continued good housekeeping policy, has [illegible] the incidence of dermatitis in our Rouge plant [illegible] than 1½ cases for each 1,000 of plant population per month.

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The Occupational Disease Hazard

—Evaluation in the Field—

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[illegible] extensive and reliable information is constantly becoming available concerning the [illegible] of industrial materials which cause injury and those which may be considered innocuous. In order to apply this knowledge on the toxic [illegible] these materials, it is necessary to have means of determining whether or not the exposure is within [illegible] limits.

The evaluation of the occupational disease hazard as we encounter it in the field is of vital importance in the economic control of a potentially injurious exposure. The two principal methods of evaluating the severity of the health hazard are through observation of the occupational environment and through examination of the worker.

Use and Limitations of Eyes and Nose

SO MUCH emphasis has been placed on chemical and physical testing of the air for contaminants that the question has been raised: Are our eyes and noses of no assistance to us in the evaluation of hazardous operations? Can only the chemist with his thermal decomposition apparatus, backed by a laboratory full of beakers, volumetric flasks and spectrophotometers, state whether there is too much trichlorethylene in the worker's breathing zone? Or must a man be armed with an interferometer or a tri-per analyzer if he is to avoid a chemical procedure for obtaining this information?

The answer is that it is necessary to utilize physical and chemical methods in many situations in order to evaluate the hazard if we wish to avoid the dangerous procedure of waiting to see if the worker's health is actually being affected. But before discussing the application of these methods, let me point out certain conditions where the eyes and nose are of use in arriving at an opinion of the hazard—and also some of the precautions which should be observed if the eyes and nose are to be employed as guides. In such sensory diagnosis of a condition, one must be on guard not only against optical illusions, but against olfactory illusions as well.

Let us make a survey of a manufacturing plant without benefit of the truck-load of gadgets which are the bane of the industrial hygienist's ambulatory excursions and find out what we can do and how far we can go in the evaluation of the health hazard.

The plant we visit includes a convenient variety of operations—but in this respect it is not different from numbers of actual plants on which many of us call or where we carry on our work. As we step from the office into one end of the factory, we find ourselves in a department where electrical receptacles are being produced of asbestos compounded with a synthetic resin. The first operation involves emptying bags of short asbestos fiber into mixers. No imagination was wasted on this operation; it is accomplished simply by weighing the burlap bag and dumping it manually into the mixer—following with a conscientious shaking of the bag to make sure it is entirely emptied. This operation is intermittent, but while it is being done there is a cloud of asbestos in the air which even the most casual observation would not miss.

The evaluation of the severity of this dust exposure requires one additional element which is often overlooked, the duration of the exposure. If a batch can be made up in 20 minutes which will provide enough material for the whole day, then it is probable that a respirator approved by the U. S. Bureau of Mines for Type A dusts would suffice. But if the operation is repeated every hour, general observation could be considered sufficient grounds to evaluate the hazard as excessive and to serve as the basis of a recommendation for control.

In the adjoining room, we find the batch being fed into molding machines and the receptacles being placed on racks. The plant superintendent is well satisfied with the effectiveness of the exhaust ventilation system installed when this new operation was begun a year ago, and he expects our approbation of the installation. It is easy to say, "Yes, that is a splendid exhaust system." But what if such an offhand comment closes the subject and six years later one or two of the dozen girls on the operation develop asbestosis? If the condition does look good, what criteria can be used as guides?

Criteria for Evaluation of Dust Hazards

IN THE first place, too quick snap-judgments should be guarded against. If an unjustified OK is given, the health of the worker may be jeopardized; if a condemnation, then money may be spent unnecessarily, to say nothing of developing a lack of confidence of management in your judgment.

In the case of the asbestos dust condition, our evaluation of the exposure should be based on the knowledge that the present toxic limit for asbestos is five million particles of dust per cubic foot of air. This is a very small concentration, so small in fact that the condition may look good even to a critical eye and still present an exposure greater than this low limit. Some indication of the amount of dust present in the air may be obtained by noting the layer of dust on nearby settling places after learning how long a time has elapsed since they were last cleaned. If only a thin layer of dust has accumulated over six months or a year and there are no visible puffs of dust escaping from the operation, it is probable that the condition is satisfactory.

In the case of asbestos dust, however, and this holds with even more certainty for dusts high in free silica content, the toxic limit is so low that the only safe procedure is to have recourse to actual dust determinations. This is especially important where the injurious condition is not immediately evident but requires years to develop as in the case of asbestosis and silicosis.

What rules can be laid down in the evaluation of dust hazards in the field? Although individual conditions call for specialized treatment, a number of general suggestions can be made.

1. Obtain some reliable indication of the free silica content of the dust. A few specific items can be mentioned. In foundries, parting compounds may be largely tripoli which is free silica or they may contain less than 5% free silica. Manufacturers' statements to the latter effect can usually be depended upon. The Compensation Inspection Rating Board of New York maintains a list of parting compounds containing less than 5% free silica for which credit is allowed in the compensation rate. Dust collected in arresters connected to sandblast rooms has been used as a parting compound in some small foundries. This of course is high in free silica.

In the rubber industry, much dust is frequently present from the use of soapstone powder or talc in preventing unvulcanized rubber sheets from sticking together. Where true soapstone or talc is used, the free silica content is low, usually negligible. Imported stocks of these materials are now disappearing from the market and ground minerals obtained in this country are being substituted. Quantities of pyrophyllite, itself a combined silicate, are being utilized as a satisfactory substitute; but this pyrophyllite may include large proportions of quartz—21 and 22%. The evaluation of the potential hazard might thus be changed from negative to severe on the basis of the free silica content of the "soapstone."

2. A second important factor in the evaluation of a dust hazard, and in fact of most of the occupational disease hazards, is the duration of the exposure. In these days of accelerated production and longer work days and work weeks, this matter of duration assumes increased importance. A year ago a man may have been exposed to silica flour two hours a week in the preparation of a paint for some one customer. An evaluation of the hazard at that time may have shown it to be negligible. Today, that customer's order may have increased so that all day long several men are weighing up batches of silica flour as the inert material for this same paint. From the point of view of the paint formula, the silica flour is part of the "inerts"; but from the industrial hygiene point of view it falls within the category of silicosis-producing dusts known as proliferative materials. And if a proliferative dust is present throughout the entire work-day and week, it should be given careful attention in order to ascertain definitely whether or not health is being affected.

3. As an aid in learning which dusts may cause injury and which are relatively safe, research has been conducted on the action of various dusts on injection into guinea pigs. The interperitoneal reaction is a measure of the effect of these dusts on being inhaled into the lungs. Publications[1] on the results of these tests may be obtained from the Division of Industrial Hygiene, National Institute of Health, Bethesda, Maryland, and it is probable that information on the reaction of certain dusts not included in these publications could also be obtained on inquiry. The dusts are divided into three groups: (1) absorptive, such as calcium carbonate or marble dust; (2) inert, such as aluminum oxide or emery dust, and (3) proliferative, such as silica flour anu tripoli. Dusts in proliferative group are those which produce silicosis on sufficient exposure.

4. If general observation does not indicate an obviously dusty condition where the free silica percentage of the dust is appreciable — in which case control measures should be immediately instituted — dust determinations should be made, unless they are obviously negligible.

Without going into a very extensive discussion of the methods of determining the concentration of the various industrial contaminants in workroom atmospheres, the standard method of dust determination in this country is the impinger.[2] This device, originated by Leonard Greenburg, has since been made more portable and is commercially available as the so-called "midget impinger" through the Mine Safety Appliances Company.[3] Other devices such as the konimeter and the Bausch and Lomb dust counter collect grab samples and are useful control instruments.[4]

Exposures to Toxic Dusts and Fumes

OUR plant survey continues and we proceed to an adjoining department where a litharge-glycerine cement is being used for attaching glass lenses to polished metal reflectors. A group of girls are working around a large table, each being provided with a one-pound carton of litharge. The housekeeping is scrupulously clean. All hygienic measures such as adequate washing facilities are provided and their use rigidly adhered to. The operation involves removal of litharge by means of a spatula from the carton onto a glass plate where a small amount is mixed with glycerine prior to being applied to the end of the glass lens. There is every appearance that conditions are satisfactory. But where workers are handling toxic materials such as lead in a powdered form, it is dangerous to take for granted that exposures are within safe limits on the basis of appearances alone. Even though lead oxide is heavy and tends to settle more rapidly than dusts having lower specific gravities, very finely divided material will remain suspended owing to air movements in a room.

It happens that general observation of just such an operation resulted in the opinion that conditions were safe. No determinations of lead in urine, of basophilic content of the blood, or of lead in air were made. Six weeks after this operation was started two of the girls developed lead poisoning, one sufficiently severe to cause a brief period of hospitalization. Any one of the three methods of determining whether the exposure was excessive would have led to institution of preventive measures.

In a separate building in the yard of our hypothetical plant, a purification process is being conducted lead sheathing which is used over and over again in connection with vulcanization of rubber insulated cable. Here tons of lead are being handled. Where the small amount of litharge in the previous department may have caused us to treat the hazard very slightly, the presence of large quantities of lead tends to result in more careful consideration. After being melted in a cupola, the lead is run into large shallow pots where the impurities were removed by fluxing. Large volumes of air are removed from the area over these 12-foot diameter pots, and, in this department also, personal hygiene is of the best. In view of the magnitude of the operation, air samples are collected for lead determination and our results show that general atmosphere throughout this building contains lead dust and fume in amounts well within safe limits.

In making any evaluation of an occupational disease hazard, it is of much importance to note carefully whether certain operations may be carried on for comparatively brief periods from time to time which may result in sufficiently excessive exposures to raise the daily and weekly absorption of such material to dangerous limits. Before concluding the collection of our air samples in this lead purifying building, samples were taken to show the exposure of the man during the fluxing operation and also while the pots were being skimmed. The exhaust ventilation removed the dust and fume properly during the fluxing, but the worker who skimmed the pot placed the wheelbarrow directly behind him and as he deposited the dross into the wheelbarrow a cloud of dust was drawn directly past his breathing level by the powerful exhaust fan over the pots. During this skimming operation it was found that there was high lead intake this worker even though the operation was of comparatively short duration. The control measure was readily apparent once this one exposure was evaluated as being severe.

Where operations introduce comparatively high exposures intermittently and with some degree of irregularity, a type of test which permits summation of these intermittent exposures is particularly valuable. If air tests can be carried on over a long time to show truly representative results, these are helpful, but the best test in such a case is the analysis of urine for lead.

With the development of rapid techniques such as the dithizone and dropping mercury electrode methods, results of urinalysis for lead are becoming more readily available as a means of evaluating the hazard, since the amount of lead excreted in the urine is an excellent measure of the total lead intake throughout the work-day.

Where the worker may be protected by means of a filter-type respirator approved for lead dust or lead fume, the worker's lips and nostrils should be closely observed as an indication of the effectiveness of this measure and of the conscientiousness of the worker in fitting the respirator properly to his face, keeping the head bands under proper tension, and holding the respirator on his face while he is being exposed to lead, even when supervisors are not in the immediate vicinity. The filter-type respirator may not be providing adequate protection even under ideal conditions, and determination of lead in urine may well be conducted as a means of verifying the general impression that the worker is being properly protected.

Exposure to Organic Solvent Vapor

On returning to the main part of the plant, we find that an insulating compound is being used to impregnate the abestos covering woven over copper cable. The bitumen used as the impregnating material is dissolved in a solvent mixture. Some years before, toluol had replaced benzol as a thinner for this material and the amount of solvent vapor getting into the work-room atmosphere was within safe limits. At the present time it should not be taken for granted that such an operation remains within safe limits, but specific inquiry should be made as to whether benzol is again being used since most of the toluol is going into the manufacture of TNT. If benzol is once more being introduced into this operation, it is still possible to keep the exposures within safe limits but it is not considered good industrial hygiene to depend upon the intensity of the odor as an indication of the concentration of benzol vapor present. The concentration of benzol can be determined by a number of methods; by air analysis using chemical methods or by such physical methods as the heat of combustion method using a device known as the benzol indicator, by the interferometer or by adsorption on such solid adsorbents as silica gel or activated charcoal.

As was the case in connection with lead exposures, an integrating method can be employed as a measure of the extent of exposure to benzol over the previous few days. This test involves the analysis of urine for inorganic and total sulphates,[8] an easily conducted test which can be made in chemical laboratories of most plants without involving special equipment. Analyses of the air are of value,[9,10] particularly in locating those areas and operations where benzol exposures are the greatest. But for the evaluation of the hazard, the urine sulphate test gives us our best information short of blood tests which do not show a positive indication until after some damage has been done.

We have mentioned that the odor of the benzol should not be depended upon in determining whether or not exposures are excessive. One of the reasons for this is that the toxic limit of benzol is comparatively low—100 parts per million being the maximum concentration to which workers should be exposed over any period of time, and, secondly, benzol is not one of the more odoriferous solvents.

Where we are dealing with some of the lesser toxic solvents many of which fortunately have more distinct odors, then the sense of smell will serve to a certain extent as an indication of the hazard. As pointed out by Patty in a publication on rapid methods for the determination of gases in the air,[7] the most universally available rapid method of detecting and estimating gaseous contamination is by odor. He cautions, however, that individual sensitivity to odors varies considerably and fatigue occurs rapidly. Consequently every opportunity should be taken for the correlation of one's individual sensitivity to odors with the concentration of the materials causing such odors usually expressed in terms of parts per million.

After one finds that he associates a strong odor of some such solvent as isoamyl acetate with a concentration of one-quarter the usually accepted toxic limits, he should keep in mind that it is the initial inhalation of such an atmosphere which should be used as an indication. If we walk slowly toward a process presenting an organic solvent vapor exposure, our noses become progressively fatigued as we approach the higher vapor concentrations closer to the operation. Consequently we may have little appreciation that there is a strong odor of the vapor even though the exposure may be within injurious limits. If odor is to be used as a criterion, a good technique to follow is to wear a respirator provided with activated charcoal cartridges. Only when the observer is at the operation itself should the respirator be removed. The opinion concerning the intensity of the odor should be predicated on the first few inhalations. Since one's sense of smell may be less intense at certain times than at others, it is a much safer procedure to use the nose to decide that the condition is dangerous where control measures can be easily taken rather than to depend upon the nose as the last word in deciding that a condition is satisfactory. It must be admitted that although the canine nose may identify a smell with certainty, the human olfactory end-organ is more convenient than reliable.

Reliability even of precise chemical methods should not be accepted blindly. It is always well to test the tester. A thoroughgoing example of checking a newly developed method is that described by Barnes and Speicher in the determination of formaldehyde in air.[8] Using an impinger with distilled water as the collecting medium, only about 50% of the formaldehyde was retained in a five-minute sample, but 93% of the formaldehyde in the air of a test chamber was consistently collected when 1.25% potassium hydroxide was used as the collecting medium.

Some of the Newer Health Hazards

OF THE newer exposures to occupational disease hazards incident to the present emergency, a mercury poisoning hazard was evaluated by Goldwater and Jeffers[11] as being excessive through observation of clinical symptoms and an interesting action pointing to the source of the exposure. A new anti-fouling paint was being used in the New York Navy Yards which had to be heated prior to its application. The men who were spraying the heated paint, or who were in the vicinity of the fumes being given off from it, noticed that any gold rings which they were wearing developed a silvery coating, obviously from the formation of a mercury amalgam. In addition to this, a silvery deposit was formed on the ship's hull in the area where fumes from the heated material made contact with it. With symptoms of mercury poisoning showing the need for control measures and the presence of this amalgam showing the source of exposure, control measures were soon instituted.

Today we are hearing much about the greatly expanding synthetic rubber industry. Acrylonitrile or vinyl cyanide is one of the initial materials for producing one or more of the "Buna" rubbers. Since the substance contains the poisonous cyanide radical, it was believed desirable to institute a study of the toxicology of this material to provide information on which to evaluate the extent of the hazard. By ascertaining the toxicity of this material, which was found to cause death of dogs on exposure to concentrations of only 110 parts per million after as little as four hours, these investigations[12] permit the proper evaluation of the hazard so that adequate precautions can be taken and industrial exposures kept within safe limits. Such means of evaluating the hazard before rather than after symptoms have developed is in line with enlightened industrial hygiene methods.

During the last war, considerable numbers of cases of poisoning from trinitrotoluene were experienced. There is much activity in this country today to avoid recurrence of such cases in our own TNT plants, but cases are already being reported from abroad. In one foreign country, a recent report gave seven cases of TNT jaundice with two deaths and, in another, a group of 13 workers had to be hospitalized as a result of TNT exposure, four of whom died. In the more effective control of dust and vapor in TNT production and loading plants in this country, improved methods of determining the concentration of this material in air have been developed. A colorimetric method has been devised by Pinto and Fahy, of the Massachusetts Division of Occupational Hygiene.[13] In shell filling operations the nose and the eyes do not provide sufficient indication of excessive TNT exposure. Actual chemical analyses of the air are necessary.

In conclusion it may be stated that in the evaluation of occupational disease hazards in the field, much can be done in spotting conditions which are obviously severe on mere observation of the condition. Where the condition presents some question as to the severity of the exposure, then specialized methods should be utilized as a measure of the degree of the hazard. As we have indicated, these determinations can be made through air analyses or through certain determinations on the urine or blood of the worker. The purpose of the evaluation of the hazard is that conditions presenting excessive exposures can be disclosed before actual injury to health occurs. After control measures have been instituted, then these checks should again be made so that it can be known definitely that they are effective.

Where it is found necessary to institute air analyses or similar technical measurements, the Divisions of Industrial Hygiene of most of the industrial states are available to manufacturers for study of their conditions. A number of the leading insurance companies also have such facilities available for concerns which they insure for compensation, and certain companies extend this service where group life or group disability coverages are in force. Some of the universities provide consultation service. Private consultants are also available. Frequently, an initial complete survey of a condition by some one of these specialized services can be followed up by inspection or by routine analyses conducted by the plant engineer or chemist. Recording instruments have been developed for such materials as carbon monoxide, sulfur dioxide, carbon disulfide and hydrogen sulfide, but the initial cost of these tend to be rather high.

Judgment and experience count for much in the evaluation of the occupational disease hazard, but where there is any question as to the need for introducing control measures, or where such control measures run into any appreciable cost or inconvenience, then this evaluation can best be based upon such specific data as is to be provided by determinations appropriate to the exposure.

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Plant Hygiene Studies

THE location, identification and control of unhealthful occupational exposures is a primary function of the industrial physician. Technically, an exposure is defined as any working condition or environment, process, operation or material used in manufacturing which is capable of causing harmful physical effects. These may, on occasion, be so obvious that workers themselves are perfectly familiar with their source. Most frequently periodic physical examination of employees will prove to be the most sensitive index of the effect on workmen of industrial exposure and inadequacy of control measures. Elsewhere, discovery requires diligent combined effort by highly trained medical and engineering personnel. In any case, systematic methods are essential in order that dependable data may be secured on which a program of adequate control can be based Plant hygiene studies have proved to be reliable and to require least expenditure of time and money. The procedure is essentially one of taking periodic inventory of unsatisfactory occupational risk.

Location of Exposures

EXPERIENCE in large and small industrial establishments suggests that plant hygiene studies are likely to be most successful if certain steps are followed:

1. A complete list of all materials used in manufacture should be secured. Those capable or suspected of causing trouble should be suitably indicated on the list.

2. All steps in manufacture should be described, preferably in the form of a diagram or schematic representation, to indicate the flow of goods from raw material to finished product.

3. Thorough inspection of the working premises is essential to test conclusions drawn from the inventory of materials and processes and to evaluate other conditions of work which are potential contributors to disability and lowered production. It must not be forgotten that harmless substances may under certain conditions or in susceptible individuals become harmful. In the same way, no matter how much care has been expended in preliminary investigation, incidental or unsuspected sources of exposure will be missed unless every feature of the working environment is carefully scrutinized.

4. A record should be made of every material, process or environment capable or suspected of causing injury or disease, the exact location of each, and the number of workers exposed.

Identification of Exposures

EXPOSURES are important by nature, extent and the degree to which they may be controlled. Most industrial hygienists believe that sufficient information exists about control methods in general to permit safe handling of all but very new or recently introduced substances in industry.

Problems of this nature likely to be encountered by the physician in industry are extremely diverse and widespread. Efforts have been made to classify them. One of the most useful outlines is the following:*

A. Abnormalities of air pressure.
B. Abnormalities of temperature and humidity.
C. Dampness.
D. Defective illumination.
E. Dust.
F. Infections.
G. Radiant energy.
H. Repeated motion, pressure, shock.
J. Poisons.

Subheadings under the major title of poisons are most numerous, and a complete list of all substances capable of causing local or systemic effects is a very considerable one. In the case of allergic manifestations arising from industrial substances, the list of potential exposures becomes almost endless.

Engineering Studies

FOLLOWING location and identification, the physician should indicate in the record his estimate of the seriousness of each exposure. If doubt exists about its exact nature or satisfactory control, assistance is needed from an industrial hygiene engineer. In fact, confirmation about the severity of most exposures is often highly desirable and it is routine practice in many manufacturing concerns for an engineer with suitable qualifications to verify all preliminary estimates. Qualitative and quantitative analyses of each exposure are available in this way for use as factual evidence if necessary. All determinations of this character should be suitably entered in the records.

Control of Exposures

AS SOON as the industrial physician has established a source of occupational disability he must set the machinery in motion for adequate control. Since the physician must in many situations recommend specific control measures or pass judgment on the effective nature of proposed or existing installations, a knowledge of the fundamentals of industrial hygiene engineering is a most useful piece of equipment for him to possess. Control procedures fall in one of the following major classifications:

1. Substitution—harmless materials are substituted for those causing trouble.
2. Alterations in processing or manufacturing.
3. Segregation of operations.
4. Capture of dusts, fumes, mists, vapors or gases at the point of origin.
5. Use of personal protective equipment.

The actual application of these general principles often requires a high degree of specialized knowledge and technical skill obtainable from properly qualified engineers and industrial hygienists.

New Processes

ALL NEW processes, materials or modifications of old ones should be investigated in much the same way and in advance of installation to prevent the introduction of unexpected exposures.

Maintenance of Control

PLANT medical inspections are an essential phase of control maintenance and consequently of the industrial physician's routine. These inspections should occur periodically. Sites of greatest exposures need frequent attention, possibly constantly repeated chemical and engineering evaluation. Others are visited in relation to their importance. Periodic plant walks by the medical department personnel throughout the entire establishment is particularly sound practice. Occasionally, inspections should be made in company with officers of the firm, particularly those responsible for production, personnel, plant conditions and safety. Active interest and cooperation from management is quite as great an element of successful medical department administration as cooperation from the workmen. Employees most emphatically need instruction and regular supervision in order that adequate understanding may exist about the continuous and proper use of protective devices.

The record system of the medical department should contain copies of recommendations leading to the installation of control measures, the date of installation and the dates of and special notations about follow-up visits and inspections. Forms can readily be devised which will facilitate

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*Taken from Bulletin 41 of the U. S. Department of Labor, "Occupation Hazards and Diagnostic Signs," by LOUIS I. DUBLIN and ROBERT J. VANE, 1941.

the uniform recording of all results of plant inspection.

Medical inspection has additional advantages. It provides opportunity for thorough familiarity with every job in the plant. Information of this character is of the greatest usefulness in relating work assignments to the physical and temperamental qualifications of workmen. It is reassuring to employees to know that plant conditions are under observation by medical personnel. It is equally satisfactory to employers to realize that proper records are available in case claims arise out of alleged unhealthful conditions of work.

Application in Small Plants

THE physician serving a small plant should be guided in his approach to unhealthful exposures by these same general principles. Frequently he will need special technical assistance. Committees on industrial health are being developed in state and county medical societies in order that the practicing physician called on to serve in industry may have access to ready sources of consultation and special information. Preliminary plant hygiene studies should in many cases be arranged through qualified consultants. Obscure exposures will require aid of this same description.

Assistance can frequently be secured by application to experienced industrial physicians or industrial hygienists. Occasionally consulting services are provided by insurance companies or trade associations to member companies. A few city and county health departments have established bureaus of industrial hygiene for investigation and consultation about occupational exposures. If local resources fail, assistance may be sought through bureaus of industrial hygiene in state health or labor departments, and these in turn have the advantage of specialized information and investigating facilities supplied by the Division of Industrial Hygiene of the U. S. Public Health Service.

American Industrial Hygiene Association

News of Local Sections

Michigan Section

THE Michigan Industrial Hygiene Society had an all-day Conference on Industrial Health Conservation, Friday, March 27, 1942, at Hotel Statler, Detroit. The program gave timely discussions of conditions affecting health in present-day industry, and of methods for conservation of the health of industrial workers, as follows:

Friday Morning

PRESIDING—MR. A. O. THALACKER, Secretary, Detroit Rex Products Co., Detroit.

"A Study of the Wilson Combustion Analyzer for Chlorinated Hydrocarbons"—PAUL F. REZIN, Field Supervisor, Bureau of Industrial Hygiene, Michigan Department of Health, Lansing.

"Toxicity of Lead Chromate"—GORDON C. HARROLD, Ph.D., Industrial Hygienist, Industrial Hygiene Laboratories, Chrysler Corporation, Detroit.

"The Determination of Zinc Oxide Fume in Air"—WILLIAM G. FREDRICK, Sc.D., Chief Chemist, Bureau of Industrial Hygiene, Detroit Department of Health, Detroit.

"Visiting Nurse Service for the Small Plant"—MISS LUCILLE HARMON, R.N., Supervisor, Industrial Nursing Service, Visiting Nurse Association, Detroit.

"Industrial Safety in Michigan and its Relation to Industrial Hygiene"—JOHN W. GIBSON, Chairman, Commissioner of Labor and Industry, Lansing.

Friday Afternoon

PRESIDING—KENNETH E. MARKUSON, M.D., Director, Bureau of Industrial Hygiene, Michigan Department of Health, Lansing.

"The Physiologic Action of Light Metals"—STEWART F. MEEK, M.D., Assistant Medical Director, Chrysler Corporation, Detroit.

"White Fingers"—WILLIAM T. KREBS, M.D., Medical Director, Hudson Motor Car Company, Detroit.

"Industrial Health Activity in Michigan"—J. DUANE MILLER, M.D., Chairman, Committee on Industrial Health, Michigan State Medical Society, Grand Rapids.

"Some Special Problems in Our War-Time Industrial Health Program"—C. O. SAPPINGTON, M.D., Dr. P.H., Industrial Consultant, Chicago.

"Fatigue in Industry"—ROBERT H. FLINN, M.D., Past Assistant Surgeon, Division of Industrial Hygiene, National Institute of Health, Bethesda, Maryland.

"Experience with Some Common Industrial Solvents"—JAMES H. STERNER, M.D., Laboratory of Industrial Medicine, Eastman Kodak Company, Rochester, New York.

Friday Evening

PRESIDING—CLARENCE D. SELBY, M.D., Medical Consultant, General Motors Corporation, Detroit, Michigan.

"Training of Industrial Personnel in Michigan"—HENRY F. VAUGHAN, Dr. P.H., Dean, School of Public Health, University of Michigan, Ann Arbor.

"Fluorographic Surveys with a Discussion of Relative Merits of Various Size Fluorographs"—BRUCE H. DOUGLAS, M.D., Commissioner, and C. C. BIRKELO, M.D., Roentgenologist, Department of Health, Detroit.

On January 14, 1942, at Lansing, Michigan, the following subjects were discussed:

"Safety at Work"—C. M. EMERSON, Personnel Manager, Wolverine Brass Works, Grand Rapids.

"Interesting the Private Physician in Industrial Health"—J. DUANE MILLER, M.D., Chairman, Committee on Industrial Health, Michigan State Medical Society, Grand Rapids.

"Syphilis in Industry"—F. J. WEBER, Past Assistant Surgeon, United States Public Health Service, Washington, D. C. (With sound film.)

On February 18, 1942, DR. LOUIS SCHWARTZ, Director, Office of Dermatoses Investigations, National Institute of Health, Bethesda, Maryland, discussed "Industrial Dermatitis in Defense Industries." DR. SCHWARTZ covered the control as well as the cause and incidence of occupational dermatoses.

Metropolitan New York Section

THE Metropolitan New York Section heard MR. GEORGE E. FERGUSON, of the Pyrene Manufacturing Company, present a talk on "Fire Gases" at the meeting held January 21, 1942. Of special interest was the variety of mixed fire gases, together with the relative quantities of each, which might be expected from the combustion of certain classes of substances. Results of work were presented where combustion was carried on i pheres varying in oxygen con from an appreciable excess to point where production of gases w essentially from destructive disti tion rather than actual oxidation. FERGUSON stressed the possibility combined effects of noxious gases atmospheres containing various c binations of them.

February 25, 1942, DR. ADELA ROSS SMITH, Division of Industrial giene, New York State Departmen Labor, addressed this group on effects of industrial dust on the lu

Chicago Section

THE Chicago Section presented subject of "Organic Solvent V Exposures" at a meeting on Jan 8, 1942. DR. MILTON H. KRONENB Director, and KENNETH M. MORSE, dustrial Hygiene Engineer, Ill Department of Public Health, Divi of Industrial Hygiene, gave the re of their medical and engineering s of carbon disulfide and hydrogen fide exposures in the synthetic casing industry. DR. JAMES H. STER of the Laboratory of Industrial cine, Eastman Kodak Company, chester, discussed the general su of "Solvent Vapor Exposures" included results of the work he had in progress concerning the of some of the newer petroleum late solvents.

February 5, 1942, the Chicago tion heard MELVIN J. EVAN "Constructive Human Relat Industrial hygiene is, of c largely concerned with technicol methods for provision of hea working environment, but through proper human relation effective accomplishment be ma this or any other phase of ind production.

Practical Application of Indu Ventilation is the subject to b sented by JOHN M. KANE, En of the American Air Filter Con Louisville, Kentucky, at the meeting on April 2. This mee to include discussion of ind problems and methods of thei tion. Since many health hazar to be controlled through remo ventilation, this subject is of value.

The Chicago Section is spo the Session on "War-Time Inc Hygiene Problems" to be held of the Midwest Safety Con May 5-7, 1942. This session, sc for Wednesday afternoon, Ma cludes the following program:

"The Industrial Health of Women Time Production"—MARGARET TERT, Women's Bureau, U. S. Depa Labor, Washington, D. C.

New Materials and New Applic War-Time Industry:

"Tellurium and Other Metallic Ma HAROLD H. STEINBERG, M.D., Medical Director, Peoples Gas, Light Company, Chicago.

"Solvents"—HENRY F. SMYTH, nior Industrial Fellow, Mellon Pittsburgh.

"Effective Industrial Hygiene on Time Conditions"—H. G. DYKTOR, gineer, Bureau of Industrial Hygiene, Department of Health, Lansing.