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FEATURES

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DISCUSSION GROUPS OPEN ANNUAL ACGIH MEETING APRIL 23

MEMBERS of the American Conference of Governmental Industrial Hygienists attending the twelfth annual meeting will convene Sunday morning, April 23, at 9:30 a. m. at the Hotel Sherman in Chicago, Ill.

Round-table discussions for the four professional groups will be held simultaneously. Chairmen are as follows: *Chemists*—Mr. A. N. Setterlind, Illinois Department of Public Health, and Mr. Dohrman H. Byers, USPHS; *Engineers*—Mr. K. M. Morse, Illinois Department of Public Health, and Mr. C. D. Yaffe, USPHS; *Nurses*—Miss Catherine Chambers, Wisconsin Board of Health, and Miss F. Ruth Kahl, USPHS; *Physicians*—Dr. H. K. Abrams, California Department of Public Health, and Dr. Harry Heimann, USPHS.

Dr. W. G. Fredrick, Detroit Department of Health, will open the Monday morning session with a talk on "The Detroit Plan for First Aid and Emergency Medical Services in Small Plants." Dr. L. M. Petrie of the Georgia Department of Public Health will lead the discussion on this subject.

Miss A. E. M. Anderson, New Jersey Department of Health, will speak on the "Consultant Implementation of a Health Service for the Small Plant." "Free Silica Estimation by X-ray Spectrometry" is the subject of a speech to be given by Dr. Kingsley Kay, Industrial Health Division, Canada Department of National Health and Welfare. A business session will follow this talk.

Reports of the standing committees will be preceded Monday afternoon by a talk on "What Organized Labor Wants from Industrial Hygiene," by Mr. Frank Burke, Director of Safety, United Steel Workers of America.

The following speeches are scheduled for Tuesday morning: "X-Radiation Exposure in Diagnostic Procedures," by Donald E. Van Farowe, Michigan Department of Health; "Unusual Exposures to Arsine in the Smelting Industry," Mr. K. M. Morse, Illinois Department of Public Health; "The

(Continued on page 14)

COVER PICTURE—Courtesy of Boeing Airplane Co., Seattle, Wash.

Cleveland Industrial Hygienists Inspect X-ray Shoe-Fitting Machines

"IT SEEMED SO EASY. Just test the machine and tell the shoe store man it needed certain repairs and adjustments, then retest and accept it. But how was the shoe man to get this work done? Sending the machine to the factory involved much work in shipping, besides a long delay. Out of 10 reliable and expert X-ray repairmen in this locality, only 1 finally consented to be bothered with the shoe fitters."

These are the remarks of the Cleveland industrial hygienists after making a survey of the shoe-fitting fluoroscope machines in their city.

The preliminary study in Cleveland disclosed 114 X-ray shoe-fitting machines in operation, none of which met all the requirements, although a few needed only minor corrections. The requirements were almost identical with those formulated by the Detroit Bureau of Industrial Hygiene and are listed briefly:

1. Foot intensity not to exceed 12 roentgens per minute.
2. Fluoroscopic screen choice up to owner but B-2 or equivalent suggested.
3. Filter of at least 1 millimeter aluminum and protected by some wearing surface.
4. Stray radiation not to exceed 12½ milliroentgens per hour.
5. Automatic timing switches, time limit 5 seconds.
6. Adequate grounding. (Very important, but difficult to accomplish.)
7. Location in store so foot opening is not directed toward persons. Also not within reach of a radiator, water pipe, or other object which makes a good grounding.
8. Three intensity control—optional on old machines.
9. Interlock switch on X-ray tube box door.
10. Sign to be placed on machines by the city to signify that it has been inspected and meets the requirements.

The initial testing included foot intensity on all machines and stray radiation measured at the viewer's and operator's waist height on most machines. The foot intensity was measured by a Victoreen condenser r-meter with a 25-r chamber. The stray radiation was measured by a Victoreen minometer with 0.001-r chamber which placed a considerable limitation on the number of locations on the X-ray machine that could be tested. An ionization chamber rate meter would have been much more suitable, but was not available at the time.

A report was mailed to the owners of the machines giving the results of the test, and stating the various conditions that required correcting and some general suggestions on how they could go about getting them corrected. It was requested that all corrections be made within 4 months. It was found that 63 percent had made some effort to comply with the time limit without further encouragement, but most of the repairs were incomplete and required several re-visits by the repairmen and the examiner. The machines were given the final inspection as quickly as possible after notification that the repairs had been made.

Millions of children and adults use the shoe-fitting fluoroscope machines, now the subject of many investigations to determine the health hazards from stray radiation and electrical shock.

A review of repaired machines showed that they could be grouped into 10 types so far as major repairs were concerned, although there were only 4 manufacturers. All machines of the three major manufacturers which were delivered after January 1949 were meeting all requirements, except installation grounding.

Having found that it would have been much better to provide explicit directions for the repairmen, Mr. Harold C. Cutter, engineer in the Bureau of Industrial Hygiene, wrote *A Manual for Adjustments of Fluoroscopic X-ray Shoe-Fitting Machines.*

Mr. Cutter, in summarizing his experiences on this study, says: "Many machines were incompletely repaired apparently because of a combination of ignorance and indifference on the part of both the repairmen and the shoe store owners even after describing acceptable methods of repair to everyone concerned. Laxity in notifying about the repairs being done was also a problem. These have been overcome to some extent after advising the owners to withhold payment until the machine had been given a final inspection.

"It is believed that the expense to the owner and loss to the repairmen because of repeat visits would have been minimized if the information in this manual had been available at the beginning of the program. The applicable parts of the Manual could have been sent to the machine owners in the form of a report with instructions that the repairman certify that each item had been corrected. This should be returned then to the inspecting agency and payment for repairs withheld until the machine was approved.

"Lack of radiation measuring instruments is a handicap for the repairmen

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but if they leave a supply of filters, the examiner having the instruments can easily make the foot intensity adjustment at the time of final inspection."

A copy of the manual may be had by writing to Bureau of Industrial Hygiene, Division of Air Pollution Control, 1404 East Ninth Street, Cleveland 14, Ohio.

ELECTRICAL HAZARD FROM UNGROUNDED SHOE-FITTING MACHINES MAY BE SERIOUS

In conjunction with a study of the radiation hazard from an X-ray shoe-fitting machine, the engineers in the Cleveland Bureau of Industrial Hygiene discovered that the electrical hazard from ungrounded machines is potentially very serious.

As a result of the study the following information and advice have been sent to owners of all X-ray shoe-fitters in Cleveland:

X-ray shoe-fitting machines normally operate at approximately 50,000 volts. There is always a possibility of the transformers or the tube becoming defective and momentarily producing perhaps twice the normal voltage. This high voltage is capable of jumping at least 3.5 inches, and sometimes a much greater distance than that, and creates a serious electrical hazard. Therefore, special precautions are necessary to provide grounding to protect the operator and persons nearby. In fact, there have been two persons electrocuted in this city in recent years because of inadequate grounding of an X-ray machine (not a shoe-fitter, however) and probably many others have received serious shocks.

The method of grounding of X-ray machines is prescribed in the municipal and the national codes. One of the cardinal principles is to provide a barrier between all points of high tension and the operator, the customer, or any other person, either in the form of distance or of a grounded surface.

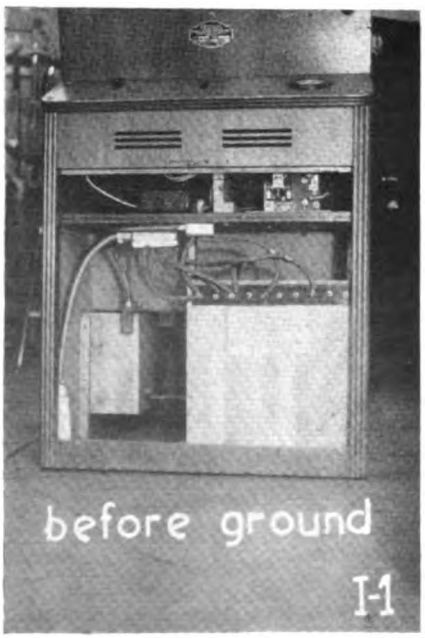
Many X-ray shoe fitters have been found to violate these codes either by faulty installations or inadequate grounding within the machines, or both. The more recently built metal enclosed machines require only minor changes, such as bonding various metal parts, if properly installed, but the older models are in flagrant violation of safe practice and require considerable alterations.

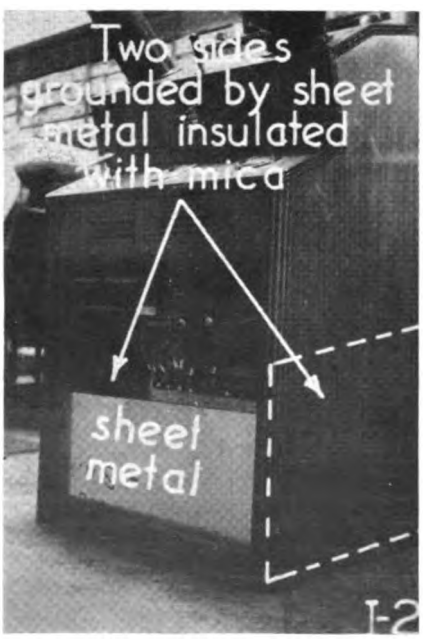
The older models manufactured for X-ray shoe fitting, which do not have the transformers, tube, and other high tension parts enclosed in a grounded metal box, present a very difficult problem. One method which appears to give good protection by grounding is briefly described. The inside of the cabinet is lined on three sides with noncorrosive sheet metal such as aluminum or copper from the floor to extend above any high tension points.

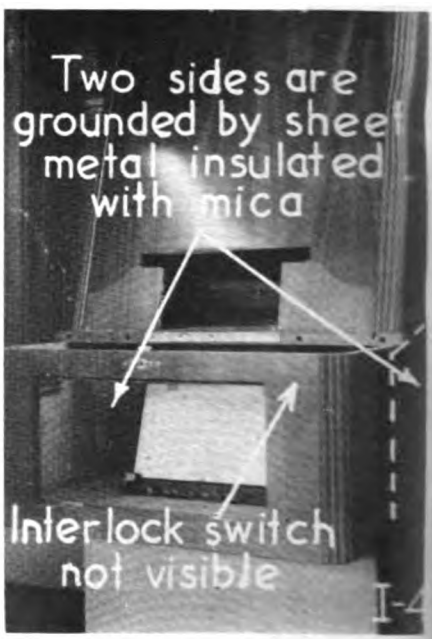
This means that the transformers have to be removed and replaced after the sheet metal is installed. On the rear or operator's side the metal need reach only to about 2 inches from the binding posts because the grounding of the binding posts protects that area. The sheet metal is extended fully across the rear and along the sides to 5 inches past the tube terminals.

These sheets are made to provide continuity of bond and are fastened to the existing conduit box which in turn is grounded in installation. The wooden front or customer's step end need not be grounded if it is 6 inches distant from the tube. The filter and other metal on the step end must be grounded. A 0.063 mica plate should be interposed between the grounded sheet metal and the tube ends and the transformers for installation because of the short distance between these high tension points.

Other electrical requirements, such as interlock switches on the tube end door







and soldered grounds on the filter and exposed metal parts, are not difficult to accomplish. The interlock switch should be mounted in a metal box and connected with grounded armored cable or conduit.

Proper grounding at installation can best be done by using three-wire cord and safety three-prong-grounded receptacles. The reason for this is because the machines are portable and may sometimes be moved and the ground wire, if separate, might not be reconnected. The three-pronged connection cannot be used in ordinary receptacles. X-ray shoe fitters must be so wired that they will automatically shut off within prescribed time as provided in the National Electric Code so persons will not be exposed to rays for a period of time which would be injurious.

SHARE IT WITH NEWSLETTER READERS

THE majority of the articles which appear in *Industrial Hygiene Newsletter* are contributed by staff members of the Federal, State, and local industrial hygiene divisions. They report on recent findings or developments in their special field of industrial health. Many of the reports are semitechnical, but some are written for the reader who is interested in all the many phases of this subject and wishes to be informed on the latest developments in other specialties than his own.

The *Newsletter* is read by many persons outside the governmental agencies who are carrying forward educational, research, and field activities. We believe it would be mutually beneficial to the readers to have a wider interchange of information, and we wish to invite you to submit articles on your program, or studies, or activities, if you think the subject matter would be of value to *Newsletter* readers.

The Publications Board reserves the right to reject or revise any contribution, but will submit all revisions to the author for his approval before publishing the article. All articles will carry the name and position of the author unless he otherwise specifies.—*Managing Editor.*

ENGINEERS HEAR BLOOMFIELD ON AIR POLLUTION

SPEAKING to the American Society of Civil Engineers at the ninety-seventh annual meeting of the society, J. J. Bloomfield asserted that the responsibility of reducing atmospheric pollution rests in large part with the engineers. He said: "Just as we have been shocked out of our apathy by the sad pollution of our waterways when that reached such alarming proportions, so, too, we must realize that the time has come that we can no longer spew contaminants into the air as a catch-all dilutant."

Mr. Bloomfield, who is assistant chief of the Division of Industrial Hygiene, Public Health Service, said: "Today we know that air pollution embodies more than the smoke aspect. We must consider the dusts, fumes, vapors, mists, and other contaminants that are emitted from industrial plants. The latter make up the more complicated phase of the problem because they do not lend themselves to a uniform solution."

"Unless we take prompt action, we may expect an intensification of this problem throughout our constantly accelerating production," Mr. Bloomfield warned. "As we undergo the tremendous growth in a variety of industrial activity in the next half century—as presaged by the increasing use of ionizing radiation, the development of plastics and a host of other synthetic products and processes, and the attempt to harness atomic energy for peaceful pursuits—it is imperative that we take proper precautions to control the resulting pollutants lest we become victims of our growth."

Although recent studies have yielded a substantial body of data, there are many unanswered questions about the long-range effects of air pollution. Mr. Bloomfield emphasized the need for research in this field. However, while further information is being sought, there is much the engineer can do in finding new and more effective control methods.

Each industry should study thoroughly its particular operations to determine what processes emit pollutants into the air as well as the nature and quantity of the contaminants. Mr. Bloomfield concluded with this challenge, "No other problem confronting the engineering profession demands more ingenuity or is fraught with more responsibility than the health of our people."

TOO MUCH FLUORINE IN DRINKING WATER CAUSES CONCERN

AN unusual problem in connection with the fluorine content of drinking water recently afforded an opportunity for cooperation between a large oil company and the industrial hygiene section and dental health services of the Texas State Health Department.

In several areas of Texas a high fluorine content of ground waters often causes severe mottling of the permanent teeth of children drinking the water between birth and 8 years, the age at which the formation of permanent tooth enamel is complete.

While a fluorine content within the limits of 1.0 to 1.5 parts per million reduces the incidence of dental caries, concentration above this range may cause severe mottling with resultant blemishing of otherwise normal teeth. This condition is known as "fluorosis."

The oil company became concerned over the possibility of this condition developing in the children of its employees living in permanent "camps" in these areas, and the advice and assistance of the State Health Department was sought in an effort to provide a solution to the problem.

A meeting was held between company representatives and State Health Department engineering, dental and chemistry personnel, and certain proposals for removing the excess fluoride were discussed. It was decided to carry out a further investigation of one promising method of reducing the fluorine content to optimum levels in drinking water consumed by children in these company camp areas.—News item contributed by Industrial Hygiene Section, Texas State Health Department.

"Teamwork in Industrial Health" Theme of Chicago Conference

FIVE professional organizations concerned with health in industry will meet at the Hotel Sherman in Chicago, Ill., during the week starting April 23. The following groups will meet jointly and concurrently: The American Industrial Hygiene Association, the American Conference of Governmental Industrial Hygienists, the American Association of Industrial Physicians and Surgeons, the American Association of Industrial Nurses, and the American Association of Industrial Dentists.

Dr. Edward C. Holmblad, Chicago, managing director of the conference, in announcing plans for the 1950 meeting, said that "the bringing together of these groups is mutually beneficial and these annual meetings serve as postgraduate courses covering the entire field of industrial health and hygiene, occupational ailments and traumatic surgery."

More than 100 papers will be read during the 8-day meeting. Some of the problems to be discussed among the physicians and nurses will be the toxic effects of materials used in industry, accident hazards, industrial medical aspects of the radioactive isotopes, treatment of injuries, X-ray interpretation of industrial cases, the use of antibiotic or "miracle" drugs, the effects of the newer treatments for arthritis, the value of an industrial eye program, back injuries, trends in vacation policies of industrial workers, periodic health examination of executives and the importance of human relations with the industrial worker.

Various section meetings will be held during the week. These will deal with general manufacturing, steel and heavy industry, petroleum, rubber and chemicals, hand and restorative surgery, workmen's compensation and insurance, and the mining industry.

On Monday afternoon and Tuesday morning, April 24 and 25, there will be hospital clinics at St. Luke's and Cook County in Chicago. These clinics will present the newer types of diagnosis and treatment of industrial injuries and the handling of medical cases. The session on Tuesday evening will be devoted to a symposium on alcoholism in industry.

All of the five sponsoring groups will gather at a joint meeting Thursday afternoon. The program will be built around the convention theme: *Teamwork in Industrial Health*, which is aimed at rendering a comprehensive, complete medical service to all industrial workers.

Interest in the field of industrial dentistry has increased so much during the past year that the American Association of Industrial Dentists is sponsoring three full days of discussions and field trips instead of two as was done in former years.

During the conference, more than 20 large industrial plants in the Chicago area will have open house in their medical departments for industrial physicians and surgeons and industrial nurses.

ELKINS REVIEWS NEW BOOK ON TOXICOLOGY

Fairhall, Lawrence T.: Industrial Toxicology. *The Williams and Wilkins Co.*, Baltimore, Md., 1949. xi + 483 pages. $6.

PERTINENT data on over 200 elements, substances, and groups of substances are discussed in some detail in this volume. Following a brief introduction, 180 pages are devoted to inorganic substances, which are listed in alphabetical order. Part II contains 275 pages dealing with organic substances, similarly arranged.

Under the heading, *Characteristics*, the important physical and chemical properties of each material are given. *Industrial Uses* includes not only the major applications of the substance, but also, in most cases, figures on annual production or consumption in this country. Paragraphs on *Toxicity* and *Analysis* follow.

The section on toxicity includes a summary of the findings of animal experiments, and a discussion of the nature of occupational intoxication, if such cases have been reported.

A valuable feature of this book is the information given on relatively uncommon substances (especially metals) which, while used in industry, are not known to have produced occupational disease. Many of these substances are not even mentioned in other recent volumes on industrial toxicology, nor are data available in the usual industrial hygiene literature.

On the other hand, Dr. Fairhall has ruthlessly condensed his discussions of the commoner industrial poisons. Thus we find as many pages (four) devoted to antimony as to lead; and benzene and benzene hexachloride each requires three pages.

Under *Analysis*, reactions which may be useful in the determination of the substance are mentioned, and references are given to published methods. No attempt is made to include detailed procedures.

A few minor criticisms are in order. The reviewer cannot reconcile himself to finding nitric and sulfuric acids listed as hydrogen nitrate and hydrogen sulfate. Inclusion of some data on excretion, by exposed workers, of such substances as lead, selenium and benzene would have been desirable. The index is somewhat heavy with names of reagents employed in analytical methods, most of which are merely mentioned. The only significant error noted was the MAC for zinc oxide fumes, which was given as 15 parts per million instead of 15 milligrams per cubic meter.

In addition to providing a valuable source of information concerning certain of the less common hazards, Dr. Fairhall's authoritative opinions on the commoner hazards are of great interest. This volume should be readily available to every industrial hygienist.—**Dr. Hervey B. Elkins, Chief of Laboratory, Division of Occupational Hygiene, Massachusetts Department of Labor and Industries.**

THE CHEMISTRY OF SMOG*

By H. H. Schrenk, Ph. D.,

Research Director,
Industrial Hygiene Foundation

SMOG means many things to many people. To residents of Los Angeles it means one thing, to residents of St. Louis another, and to residents of Donora still another. To one group it may be associated with irritation of the eyes, to another darkness at midday with accompanying soiling of clothes and household furnishing, and to another a menace to health.

The word smog is a combination of the words smoke and fog, and is usually used to designate an atmospheric condition characterized by a marked decrease in visibility and frequently associated with some degree of irritation of the eyes and respiratory tract. The condition is caused by the accumulation of atmospheric contaminants and the formation of fog during periods of stable atmospheric conditions when there is little or no air movement.

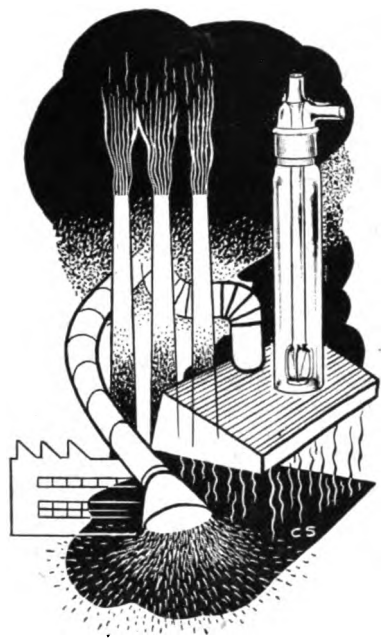
One might infer from the origin of the word smog that it refers only to particulate matter, but through usage its meaning has become much broader and actually includes all other contaminants that accompany it. While smogs are the result of abnormal weather conditions, their effects are due to the constituents present and hence the chemistry of smog is an essential factor in their evaluation and control.

What are the sources of atmospheric contaminants? How are they formed? What is the interrelationship of the contaminants after they are disseminated into the air?

Sources of Atmospheric Contaminants

Virtually every process or operation that produces gases or fine particles is a potential source of atmospheric contaminants. Combustion of fuels, incinerators, industrial operations, traffic, building and highway construction, and windstorms are typical examples. Since the raw materials being handled are the primary sources of atmospheric contaminants, an inventory of such materials is an essential first step in an investigation of the constituents of smogs.

The information obtained sheds light not only on possible contaminants but also on amounts. In making the inventory the composition of the raw materials must be determined, as impurities, even if present in relatively small amounts, may be significant if large amounts of material are being processed.



Formation of Atmospheric Contaminants

The next step in the evaluation of potential atmospheric contaminants is a study of the chemical reactions which occur in the processing of the raw materials. The combustion of coal may be considered as a relatively simple example. If coal consisted entirely of carbon, and if it were burned completely, only carbon dioxide would be formed. However, in addition to fixed carbon, coal contains varying amounts of volatile matter, incombustible material, and various elements such as sulfur, nitrogen, and many others in trace amounts, including fluorine. Therefore, in the utilization of coal as a fuel a number of atmospheric contaminants may be produced—carbon dioxide and carbon monoxide from the carbon, tar and soot from the volatile matter, fly ash from the incombustible material, sulfur dioxide from the sulfur, and traces of other constituents.

Proceeding one step further, it is possible to obtain an estimate of the over-all contribution of coal, used as a fuel, to the general atmospheric pollution load if the composition of the coal is known and if information is available on the percent of the various constituents which are discharged with the flue gases and the amounts retained in the ash. In other words, a study of material balance. For example, if a coal contains 2 percent sulfur and if 10 percent is retained in the ash and 90 percent is discharged as sulfur dioxide one can readily calculate that for each ton of coal burned 72 pounds of sulfur dioxide will be produced.

While the problem of atmospheric contaminants from coal may seem relatively simple from this brief discussion, it is much more complex and actually the amounts produced may vary considerably depending on various factors. For example, the products produced during carbonization of coal may differ widely from those produced during combustion.

Inventory of Raw Materials Is Complex Problem

The same basic procedure of inventory of raw materials, study of chemical reactions and material balance is in general applicable to industrial plants. The problem, however, is usually more complex owing to the number of raw materials and the necessity of following a constituent step by step through the various processes to the final product.

For example, in the production of zinc from sulfide ores by the horizontal retort method, the first step is the roasting of the ore which removes the sulfur as sulfur dioxide. The sulfur dioxide is usually collected and made into sulfuric acid. The next major step is the sintering of the zinc oxide formed during roasting. In this step additional sulfur dioxide is evolved as well as various metal oxides as cadmium and lead. In the final major step zinc is produced

*Presented here by the courtesy of the Industrial Hygiene Foundation.

from the zinc oxide. During this process some zinc oxide escapes from the spelters into the general atmosphere.

Knowing the amount of zinc in the original concentrate and the amount of zinc produced, the amount lost in the various steps can be calculated. More precise information on the amount of contaminants discharged into the air can be obtained by calculations based on volume and composition of stack effluents.

The basic information outlined above has two important applications: (1) control, by indicating major types and sources of pollution, and (2) evaluation of general atmospheric pollution. Control will not be discussed as it does not come within the scope of this paper.

What Happens to Contaminants Discharged Into the Atmosphere?

The chemistry of smog constituents, however, does not cease with their discharge into the atmosphere. The possibility of oxidation of some constituents and the interreaction of the numerous constituents which are usually present, is almost unlimited. Sulfur dioxide which is present in the air to some extent in most cities probably has been more widely studied than any other single atmospheric contaminant, yet there is still considerable discussion regarding what occurs to it in the atmosphere. It is well known that sulfur dioxide can be oxidized to sulfur trioxide. It has also been demonstrated that a sulfur dioxide-air mixture when passed through a quartz tube irradiated by ultraviolet light forms a sulfuric acid mist.

However, the reactions that take place and the extent to which sulfur dioxide is oxidized to sulfuric acid in the atmosphere is not known. Does gaseous SO_2 oxidize to SO_3 directly, or is it necessary to first form sulfurous acid? Does sunlight promote the reaction? What is the role of particulate matter in promoting the reaction? Is the action one of catalysis or the formation of inorganic sulfites which are subsequently oxidized? The possible reactions of the inorganic acids, metallic oxides and other inorganic materials, ammonia and other alkaline substances are numerous. Hydrogen persulfides and organic peroxides have been mentioned in the Los Angeles studies.

Are the reactions which take place during relatively clear periods when dilution is great the same as the reactions which take place during stable periods when there is an accumulation of contaminants which enhances possibility of contact and reaction time plus moisture usually present under such conditions as fog? It is evident that the chemistry of smog is complex, but the answers to such questions are essential for the evaluation of the effects of atmospheric contaminants on persons both from the standpoint of nuisance and health. The basic equipment, methods and know-how are available, but these resources must be organized and directed if results are to be obtained efficiently and without undue delay.

Donora Study Provided Practical Experience

While the previous discussion may seem theoretical, actually it is based on practical experience. The basic procedures outlined were followed in the Donora investigation. Since the magnitude and significance of the Donora smog was not recognized until after the episode was essentially over, it was necessary to try to reconstruct the picture from data collected after the occurrence of the episode.

It seemed reasonable to assume that the same kinds of contaminants which were present during the smog would also be present during the period of the study since the same raw materials and processes were being used. This was particularly so, as no evidence was uncovered during the investigation that would indicate that some unusual substance had been emitted into the atmosphere or that there was an accidental occurrence which produced unusual quantities of some particular substance during the smog episode.

The first step in the engineering phase of the investigation was to obtain an inventory of the raw materials being used, which included fuels as well as materials being processed in the plants. The next step was a study of flow diagrams, processes, and production figures. This information served as a basis in selecting sampling locations to determine significant points of discharge of contaminants. The results of the analysis of these samples in conjunction with volume of gases discharged permitted calculation of the amounts of contaminants emitted.

Sampling at the source before there was opportunity for dilution also provided information on contaminants which were present in concentrations of such a low order of magnitude that when dispersed into the general atmosphere they would be difficult to determine with reasonable accuracy. Another important point is the relative concentration of the various constituents, which is valuable when considering possible physiological effects. For example, the physiological effects of gasoline engine exhaust gases is determined by the carbon monoxide content. The concentration of this constituent in relation to other possible toxic constituents is so great that they are of no significance.

On the other hand, the concentration of carbon monoxide in Diesel exhaust gases may be so low that the oxides of nitrogen become significant. This point is emphasized because it is sometimes possible to eliminate a substance from further consideration—for if it were present in a concentration capable of producing even a mild effect, another substance would be present in such a high concentration that immediate serious effects would be produced.

Weather Data Important In Smog Study

The data on kinds and amounts of contaminants produced in the Donora area were supplemented by samples collected at representative air sampling locations to obtain a picture of the distribution of the contaminants in the general atmosphere. For such determinations to be meaningful it was necessary to obtain records of the various meteorological elements, such as wind direction and speed, temperature, relative humidity and rainfall.

Air turbulence and winds may be considered a giant ventilation system analogous to the ventilation of a plant or a vehicular tunnel. As long as the system is working efficiently the contaminants are adequately diluted and removed, but difficulties immediately arise if the ventilation is stopped. Unfortunately we cannot control the weather. Therefore, it is necessary to be prepared for a "break-down" of the "ventilating equip-

ment." This further emphasizes the need for an intimate knowledge of the chemistry of smog.

It is well to point out that while winds dilute and distribute the contaminants they do not alter the constituents or the relative proportions. One other factor regarding atmospheric concentration of contaminants and meteorology deserves attention. Although a condition of marked stability may exist there are local microturbulences which cause mixing and some degree of dilution. Therefore, while calculations based on the assumption that all the contaminants emitted are completely retained for long periods in a relatively small area are excellent mental gymnastics they are not likely to provide results that are worthy of any practical conclusions.

Five Substances Contribute to Total Atmospheric Load

From the studies of raw materials and processes used in the Donora area the following substances were selected for further investigation either in the stacks or the general atmosphere or both: sulfur dioxide, total sulfur, chloride, fluoride, oxides of nitrogen, arsine, stibine, hydrogen sulfide, carbon monoxide, carbon dioxide, and total particulate matter consisting essentially of carbon, silicates, and compounds of zinc, lead, cadmium and iron. The results are presented in the Donora report and are too detailed to repeat here.

A review of the results shows that the major contributors to the total atmospheric load were total particulate matter, sulfur dioxide, total sulfur (mainly sulfur dioxide), carbon monoxide and carbon dioxide. It will also be noted that these constituents were rather evenly distributed throughout the area indicating multiple sources of emission. The other constituents were present in much smaller amounts and tended to be associated with a particular source of emission.

Each substance was considered individually from the viewpoint of concentration found in the general atmosphere, estimate of total amount emitted, the clinical syndrome of the persons affected, and available toxicological information. It did not appear probable that any one of the substances, acting by itself, reached a level which was capable of producing the syndrome observed. However, a summation of action of several of the substances may have been responsible for the syndrome.

It is believed that the data on the kinds and amounts of contaminants and the clinical syndrome were adequate, but evaluation of these data was handicapped by inadequate toxicological information. The substances encountered are well-known toxicologically, but the data available pertain to acute effects or to effects on workers in relatively good health and for exposures of 8 hours daily.

Furthermore, the data are confined almost entirely to the effects of single substances. Nevertheless, these data were helpful in that they indicated the relative toxicity of the substances. However, when dealing with atmospheric contaminants, one must consider continuous simultaneous exposure to various substances over many hours, as well as effects on the aged, persons with impaired health, and hypersusceptible and allergic individuals.

Unfortunately, our knowledge of the physiological action of mixed gases is meager and the influence of aerosols on the physiological effects of gases is almost unexplored. In attempting to evaluate the effect of smogs the difficulty lies not in obtaining data but in the lack of basic information on which to base valid interpretations. Fundamental studies are essential to develop a foundation on which to build sound atmospheric pollution control programs.

Clinical Conferences Held by U. of Cal. on Industrial Medicine

THE University of California at San Francisco has been conducting a series of weekly clinical conferences on industrial medicine. These conferences are not part of the formal medical curriculum, which is already overburdened, but have been organized for the voluntary attendance of those students, residents, fellows, practicing physicians and others whose interest and schedules permit. This new venture in a field little emphasized in medical education has met with a favorable response and is manifesting gradual growth in both attendance and participation.

The subject matter in the first series of Tuesday morning sessions included an introductory meeting at which time members of "The Industrial Medical Team" were presented. This served as a means of demonstrating the roles of the industrial physician, the industrial nurse, governmental agencies and insurance representatives in relation to a specific case problem in industrial medicine.

Subsequent conferences have been devoted to consideration of the causes and consequences of illness absenteeism, the specific occupational diseases and their control, problems in management of traumatic injuries with emphasis on the psychological and social consequences of disabling injury, and industrial medical implications of ionizing radiations.

For the remainder of the year, the subjects scheduled for presentation will cover other facets of industrial medicine, including dermatologic, cardiologic and chronic disease problems; administrative practices, including aspects of legal medicine involved in compensation insurance; and demonstrations of rehabilitation as a means of diminishing morbidity.

One session scheduled for Wednesday, March 15, 1950, will bring a referee from the Industrial Accident Commission to the School of Medicine for presentation of a "live" hearing of a litigated claim for compensation. The practice of demonstration of actual "clinical material," in a broad sense, is followed whenever possible.—**Leon Lewis, M. D., Lecturer in Industrial Medicine.**

(Editor's note.—Any medical or engineering school offering lecture courses for industrial personnel is invited to contribute an article on the work to the *Industrial Hygiene Newsletter.*)

NEW JERSEY STRESSES NUTRITION EDUCATION FOR PLANT WORKERS

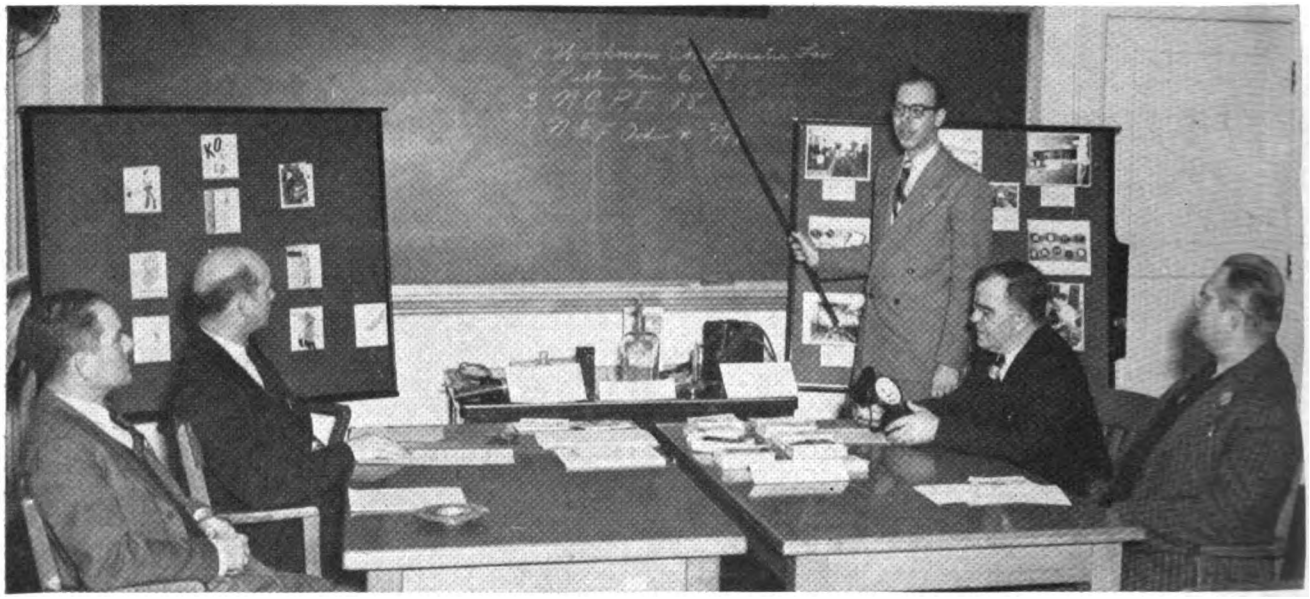
UNLESS an educational program proceeds simultaneously with the installation of eating facilities for workers, the nutrition program is incomplete, according to New Jersey's pamphlet on industrial nutrition, which was recently issued. The pamphlet is No. 1 in volume 4 of the *Industrial Health Bulletin* series which is prepared by the Division of Industrial Health, New Jersey Department of Health, Trenton.

The objectives in the promotion of industrial nutrition are, quoting: "* * * to keep workers at the peak of health and working efficiency, insofar as possible, through adequate and nutritionally balanced meals. Such a nutrition program for workers must be set up to proceed simultaneously along three lines: (1) Education of worker, (2) education of the management and food operators, and (3) provision of food to meet the basic seven-menu pattern which meets the nutritional requirements of the workers.

"This program must of necessity encompass: (1) The redirection of the workers' eating habits, not only in the plant but also those in the home; and (2) the coordination of the medical, toxicological and safety programs of the plant with the nutritional needs of the worker of each individual plant."

Factors influencing nutritional needs and those determining the type of service are discussed in the pamphlet as well as recommended practices for in-plant feeding policies and techniques.

SHOP SUPERVISORS LEARN ABOUT HEALTH PROGRAM FOR WORKERS



Mr. C. P. Bergtholdt met with small groups of shop supervisors from the Naval Gun Factory to explain the services of the industrial hygienist and to discuss the health problems of the different shops.

FIVE HUNDRED shop supervisors in the Gun Factory and other activities of the Potomac River Naval Command, Washington, D. C., heard Mr. C. P. Bergtholdt, industrial hygienist, explain the services available to them from the industrial hygiene section of the medical department. This talk was one of a series in a work improvement program conducted by the Naval Gun Factory.

Mr. Bergtholdt described the exposures in the Gun Factory that are considered potentially hazardous to the employees' health and demonstrated briefly the use of equipment for sampling, measuring, and testing the working environment. He explained the measures often taken to protect the workers' health. These include local exhaust ventilation, isolation, or enclosure of processes, substitution of less harmful materials, personal protective equipment, and adequate medical services including physical examinations.

Mr. Bergtholdt discussed the integration of the industrial hygiene and safety programs and the ways in which they can improve the working conditions of the employee and the supervisor. He advised the men to take advantage of the services of the medical department, which include the preemployment and periodic physical examinations as well as the preventive medical service.

"Every effort is made by the Navy to conserve the health of the industrial worker and to prevent occupational disease," Mr. Bergtholdt told the men. Investigations may be requested of any potential health hazard in the working environment, and recommendations will be made for adequate control.

Through the cooperation of the United States Public Health Service, each supervisor received a set of the Workers' Health pamphlets to use for future reference regarding health questions in their shops.

Whole Man Concept Replaces *Hired Hands* Attitude in Mental Hygiene Program

By Harold A. Vonachen, M. D., Milton H. Kronenberg, M. D., and Max H. Forster, M. S., Caterpillar Tractor Co.

TODAY, industrial management must recognize that much of industry's stability, efficiency and competitive edge is dependent upon the individual adjustments of its people. The expression *hiring hands* to perform work was typical of the thinking of many industrial leaders of past years. Unfortunately, remnants of such thinking still exist in many places in companies today.

Modern management has begun to learn through practical experience, however, that the industrial employee is the *whole man*—his total physical, mental and emotional make-up in action in a complex environment. When a man's hands are hired, his abilities, skills, interests, emotions, experiences, total body and personality are also hired. The industrial management that overlooks this crucial point and does not give it proper attention can be likened to a management that would buy a cutting tool with disregard for the total machine in which it was to be used.

Through years of dealing with man's ills, physicians have learned that man comprises more than a physical organism. The psychological functions have become more and more recognized as a part of man's health and hygiene, and so has come the emergence of psychosomatic medicine. Thus it is only natural that industrial medicine should turn its attention to mental hygiene practices as it works to maintain and improve the health of the industrial employee.

As executives and physicians become more aware of the totality of man's psychophysical make-up, which sets him out as an individual in a complex industrial environment, there comes the pronounced demand for more adequate means of fully understanding and managing the employee. As medicine has taken its necessary place in the industrial organization, so must the techniques, practices, and principles of psychology become fully established in sound, comprehensive, practical programs designed to aid industry in its management and understanding of the whole industrial man.

For several years many firms have gone far in the administration of psychological tests to measure human aptitudes, interests, personality traits and special skills. Some managements have developed comprehensive studies of the worker's attitudes, opinions, and morale. Other companies have used counselors to give employees outlets for personal problems.

These and other psychological functions have contributed to the understanding and management of men in industry. It seems, however, that even greater gains toward sound industrial management and the general welfare of the people, the vital core of industry, can be attained from comprehensive mental hygiene programs. Such programs can draw together the many usable psychological techniques and practices into one program aimed at mental hygiene through good adjustment of individual people in industry.

At Caterpillar Tractor Co., Peoria, Ill., following years of background study and functions of the medical division, combined with a research project conducted by Cornell University, a mental hygiene program was developed in 1946 to offer a comprehensive plan of psychological functions. Since the organization of this program, mental hygiene has become an integrated part of the total management function.

The mental hygiene program, as a section of the medical division, has gained the operational advantage of combining the functions of the personnel consultant (an industrial psychologist) and his staff, with the total facilities of the medical division for a full evaluation of people in their total make-up. This program is still in its infancy and its current research points the way to further development.

The Caterpillar mental hygiene program, with its primary objective of healthy employee adjustment, functions in three major areas in interrelated activities with other divisions of the company's management as shown in the accompanying chart.

Within this framework of activities of personnel selection and placement, employee counseling and adjustment studies and supervisor development are performed the general functions of industrial psychology combined into one plan.

Personnel Selection and Placement

Personnel selection and placement is a major area of function in the Caterpillar mental hygiene program, for good employee selection and proper placement are considered basic to sound human relations in industry. In this area, the activities of the mental hygiene program are closely integrated with the employment procedures of the personnel division.

The mental hygiene staff, acting as an arm of the medical division in applicant examination, conducts preemployment psychological testing and diagnostic interviewing in order to appraise job applicants' abilities, skills, interest, and general adjustment. The information gained from tests and applicant consultation is presented in briefly summarized evaluations and recommendations to the employment supervisor for use in the final selection and placement of employees. This information is used in conjunction with personnel interviewer's observations and appraisals along with data from the application blank and other sources of information.

It should be pointed out that the function of the Caterpillar mental hygiene program in personnel selection and placement is primarily a "man analysis" in terms of his general characteristics and potential adjustment to the industrial environment. Since Caterpillar operates generally on a promotion-from-within basis, most new

employees selected for factory work start on basic jobs from which they may be promoted or transferred. Therefore, except for technical jobs, training positions, and highly skilled work for which special test batteries have been developed, tests are not specifically job related.

A unique feature of the preemployment man analysis is the diagnostic interview. This interview is used to fully interpret tests results, gain related information, and prepare the applicant for adequate orientation in the company by discussing with him his general characteristics and adjustment relative to the needs of industrial environment. (Along the line of new employee orientation the mental hygiene staff has also played a part in the preparation of material for the company's induction program.)

As a part of the preemployment diagnostic interview, observations and test findings are recorded on follow-up cards for persons whose adjustments do not appear to be totally adequate. If such persons are hired, follow-up employee counseling and discussion with supervision is performed to help develop these employees.

Along with these functions of the mental hygiene program in personnel selection and placement, the personnel consultant leads weekly conferences with the personnel interviewers to discuss basic psychological principles and the techniques and problems of interviewing.

Counseling and Adjustment

The second major function of the Caterpillar mental hygiene program is employee counseling and adjustment studies. The counseling program is designed to function as follows: (1) Administer minor psychotherapy to employees with adjustment problems; (2) give consultation to supervisors in the management of employee problems; (3) furnish psychological data with interpretations to company physicians; (4) assist in arranging necessary leaves of absences, transfers and other job changes through recommendations based on case findings; (5) assist employees and management in referrals of severe adjustment problems to private and community care; (6) consult with physicians and supervisors relative to post-treatment rehabilitation and adjustment of employees who have undergone severe mental and emotional disturbances, and have been declared capable of return to work; and (7) maintain case records on all reported cases of employee adjustment problems.

Employee problems with many types of disruptive factors which are reflected in poor adjustment are handled by the counseling service of the mental hygiene program. Employee problems are presented to the counseling staff through employment self-referral, supervisor referral, physician referral, and miscellaneous contacts with other divisions of the industrial relations department.

Cases range in complexity from those of mild job disgruntlement up through severe personal problems which involve marital difficulties and other disturbances external to job, some of which have culminated in complete personal disorganization. In handling this broad range of employee problems, active consulting relationships are maintained with community agencies, clinics, hospitals and private physicians.

In the function of employee adjustment studies, controlled research has been developed to analyze personnel trends and practices, to evaluate management personnel tools, and to study group and individual differences in adjustment as reflected by case histories and surveys. The mental hygiene program in this area has related its activities and data to the functions of general management programs for studying employee attitudes and developing personnel policy and practices.

Supervisor Development

The third major function of the Caterpillar mental hygiene program is supervisor development. Although this phase of the program is in its early stages, it is believed that good development of supervision, in sound human relations practices, is an essential and integral part of the whole plan for healthy employee adjustment. It is also well recognized that the personal characteristics and behavior of leaders have a strong influence on the adjustment of the people whom they direct. Therefore, the mental hygiene program is working toward more effective means of supervisor selection and makes the counseling service conveniently available to supervisors for informal talks about personal problems.

The main emphasis of the program, as it is now developed, is upon the training of present supervision in basic psychological principles and good human relations management. This training is done in an organized way through courses in the training department and informally through contacts between the personnel consultant and individual supervisors. Throughout all training contacts, the point is emphasized that the mental hygiene program is a program of the total management and the mental hygiene staff in the medical division is only its nucleus as a service center.

In an orientation program designed to furnish all new supervisors with a general presentation of the company's organization, practices and policies, the medical division conducts two sessions of discussion on matters of human relations. The medical director leads one session on the general principles of human relations in industry and the personnel consultant heads another session for the discussion of attitudes, their development and significance. In this orientation training, many actual cases of employee problems are presented for group participation in analyzing and discussing common problems. Through this discussion the whole mental hygiene program is described to the new supervisor and his part in it is emphasized.

Along with the supervisor-induction program is presented periodically a course in practical psychology, in which any supervisor may voluntarily enroll. This course encompasses a very simple discussion in common terms of the following subjects presented in a series of five sessions: Human Behavior in Daily Problems,* Intelligence and Perception, Learning and Motivation, Emotions and Personality Traits, and Human Adjustment or How Man Solves His Daily Problems.

With the formalized sessions for supervisors is coupled the individual development of supervisors through the personal contacts made with the personnel consultant in the handling of employee adjustment cases. Through these contacts, the supervisor's important and immediate relationships with employee problems are emphasized and much is done to furnish directly to him

*Dr. William Menninger's recording of *Meet Your Mind* is used in the first session.

(*Continued on page 15*)

AFL Tobacco Workers Obtain Health and Welfare Benefits in Collective Bargaining Agreements[1]

By Walter J. Lear, M. D., USPHS

ALTHOUGH current attention is focused on the health and welfare programs which the larger companies and unions are including in their collective bargaining agreements, equally interesting developments are taking place in smaller industries. An illustration is the health and welfare benefits provided by agreements between the Tobacco Workers' International Union (AFL) and five tobacco manufacturers: (*a*) American Tobacco Co., Inc., (*b*) Brown & Williamson Tobacco Corp., (*c*) Liggett & Myers Tobacco Co., Inc., (*d*) Philip Morris & Co., Ltd., and (*e*) Scotten, Dillon Co.

Health and welfare programs were incorporated into these agreements largely since the end of World War II. They covered approximately 22,000 members of the union by late spring 1949, which represents nearly two-thirds of its membership. About 9,000 members of the union in three firms (companies *c*, *d*, *e*) receive some type of prepaid hospital and physician care as part of these programs.

Physician care for 2,900 members in two firms (*c*, *d*) includes specified nonsurgical benefits in the hospital. Data are not available for maternity benefits accorded women workers. No plans include physician care in the home and office except for specified surgical procedures. About 16,000 members in two firms (*a*, *c*) are covered by temporary disability insurance (weekly payments to provide income maintenance during periods of lost time due to nonoccupational sickness or accident). Life insurance and retirement benefits are also provided to a large number of workers under those contracts but are not discussed in this article.

The health and welfare programs in the contracts with two firms (*a*, *b*) do not include prepaid hospital and physician care, but this is provided by company-sponsored and company-financed programs outside the agreements. In addition to these five firms, several other tobacco companies provide various types of benefit plans for their employees which are not included in their contracts with the union.[2] These programs which are outside collective bargaining are not included in this survey.

Neither the union nor the manufacturers have sought to establish industry-wide bargaining or patterns. Separate negotiations are conducted on a plant-

by-plant basis, or a multi-plant basis and not on a company-wide basis. As a result, variations in contract terms are not uncommon. However, the programs tend to be similar throughout all the plants of a company. In general, this is due to the policy of management to extend equal benefit coverage to all its employees wherever possible, and to the coordination of the union's proposals by participation of representatives of the national office of the union in local negotiations.

The collective bargaining agreement itself generally contains only a brief statement that certain benefits will be provided by the company. An example is the clause in the agreement between Philip Morris & Co. and the union:

"On January 1, 1949, revised and extended employee benefits connected with group life insurance and group hospital, medical-surgical insurance will be effected. Announcement of all benefit programs with full explanations, including the company's retirement plan in booklet form will be distributed to each employee as soon as possible."

In only a few instances is the program outlined in any great detail. Thus the agreements do not reflect fully the more or less informal discussions and occasionally prolonged explorations between management and labor on the adoption or expansion of existing benefit programs.

These preliminary meetings for presenting the views of the union and the employer, the careful consideration of the various proposals, and the subsequent inclusion of benefit plans in the agreement are indicative of the amicable labor-management relations between these five companies and the union. These developments preceded the recent decisions of the courts and the National Labor Relations Board requiring employers to bargain with their employees on pension and benefit programs if so requested.

Hospitalization benefits covered by the agreements are provided through the seven Blue Cross plans serving the areas in which the plants are located.[3] These vary considerably in the type and amount of benefits provided. Two plans provide cash allowances of $5 and $6 per day, respectively. The other five plans provide service benefits, two in semiprivate and three in ward accommodations.

The number of hospital days provided range from 21 to 120 in the different plans, with three providing additional days after the first year and three providing additional days at less than normal rates.

All provide auxiliary services specified as to kind and amount. Various usual restrictions on eligibility, waiting periods and exclusions apply here as well as to

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[1] Adapted from an article entitled "Benefit Plans in Agreements of AFL Tobacco Workers" by Evan K. Rowe and Thurza J. Brannon, which appeared in the October 1949 issue of the *Monthly Labor Review*, with additional material added. The information is obtained from part of a long-range study of employee benefit plans under collective bargaining conducted jointly by the Division of Industrial Hygiene, Public Health Service, the Division of Research and Statistics, Social Security Administration, both of the Federal Security Agency, and the Division of Industrial Relations, Bureau of Labor Statistics, United States Department of Labor.

[2] These companies include, among others, P. Lorillard Co., Bloch Bros. Tobacco Co., and Larus & Bro. Co., Inc. In the case of another large tobacco company, R. J. Reynolds Tobacco Co., no agreement is in effect with the AFL Tobacco Workers' Union.

[3] Durham, N. C.; Richmond, Va.: Toledo, Ohio; St. Louis, Mo.; San Francisco, Calif.; Louisville, Ky.; and Detroit, Mich.

the physician care and temporary disability benefits described in the next two paragraphs.

Physician care benefits are provided through five medical society and two Blue Cross plans which, with one exception, serve the areas in which the plants are located. In one city, where no local medical society plan exists, physician care benefits are received locally, but are paid for by the medical society plan in a distant city where the company has its headquarters. In this plan and in four others cash payments are made for surgery according to a fee schedule and the patient is responsible for charges exceeding these amounts.

In two plans the physicians accept the scheduled fee as full payment from patients whose income falls below a specified limit ranging between $2,000 and $3,000, while in the case of those with higher incomes these two plans permit the surgeon to charge more if he chooses. Three plans make cash reimbursements for specified amounts of physicians' care in the hospital other than surgery. Several of the plans also provide certain auxiliary services.

The temporary disability benefit programs of the two companies having them are quite similar. Each company pays benefits for a maximum of 10 weeks in any 12-month period, beginning with the second week of disability or the sixth day of absence from work. The weekly benefit varies between $8 and $10 in both companies. Generally the $10 rate is found in the more recently renegotiated contracts.

All benefits provided the worker under the agreements with the union are employer-financed except in one program where maternity coverage is optional and at the employee's expense. Where provisions are made for including dependents, the individual worker may include his family at his own expense through pay-roll deductions.

All the benefit programs are administered by the company, the insuring agency, or both. Instances of union participation in the administration were given by some of the local unions, but no such provisions were found in the written agreements for these locals.

Except for the enrollment procedure and the payment of premiums by the companies, the administration of the medical care benefits is done entirely by the local Blue Cross and medical society plans. The two temporary disability benefit programs are self-insured by the companies concerned and benefits are paid directly to the employee by the company.

Dr. Felix Reviews "Mental Hygiene in Public Health"

Lemkau, Paul V., M. D.: Mental Hygiene in Public Health, McGraw-Hill, New York, 1949. 396 pages. $4.50.

THE NEED for applying to the mounting problem of mental illness the preventive techniques which have resulted in the successful control of other types of diseases has long been recognized. Dr. Lemkau's book presents, in compact form and readable style, the specific methods for meeting this need which have evolved to date.

Following introductory chapters which summarize present knowledge of personality structure and the development of preventive measures based on this knowledge, the author reviews the efforts made by Federal, State, and local governments to incorporate these techniques into public health programs.

This section of the book answers, by its rich, illustrative material, the questions raised by many public health officials as well as community leaders as to practical ways of using limited mental health funds and personnel in developing prophylactic and treatment services. Although the experimental nature of these projects is pointed out and no evaluation is made, the varied examples cited provide helpful suggestions on the administrative and organizational aspects of public mental health programs.

In the second and major section of the book, Dr. Lemkau reviews the development of the individual, beginning with hereditary and prenatal factors and following through to extreme old age. This is a nontechnical and extremely compact summary of well established facts about the mental and emotional development of the normal individual. It deals with the problems which are common to most people, but which are nevertheless troublesome; and it provides helpful suggestions for handling them.

If all public health workers read this one section of this one book, the integration of mental hygiene into public health practice would be advanced. If it were likewise read by teachers, ministers and others dealing with masses of people, the groundwork on which prophylactic programs could be built would be laid.—**Robert H. Felix, M. D., Director, National Institute of Mental Health.**

List of Articles on Industrial Dental Care Available

A BIBLIOGRAPHY on *Industrial Dental Care* has been compiled by the Division of Industrial Hygiene, Public Health Service.

This list of publications has been compiled in response to an increasing number of requests from members of the dental profession, industry, labor, and governmental organizations for sources of information concerning industrial dental care. The publications listed include most of the articles which have appeared in the periodical literature through August 1949, and the list is expected to be very useful to persons interested in the field.

Copies are available from Dr. F. J. Walters, Division of Industrial Hygiene, United States Public Health Service, Washington 25, D. C.

DISCUSSION GROUPS—

(Continued from page 2)

Present Status of the Air Pollution Problem," Mr. J. J. Bloomfield, USPHS; "The Health of Workers in Ferrous Foundries of Illinois," Dr. Harry Heimann, USPHS.

Meetings of standing committees have been called for Saturday, April 22. The executive committee will meet at dinner Saturday evening. Sunday at 7 p. m. the directors of State and local industrial hygiene programs will meet with staff members of the Division of Industrial Hygiene, USPHS. Chairmen of this meeting are Dr. A. S. Gray, Connecticut Department of Health, and Mr. J. J. Bloomfield, USPHS.

Industrial Hygiene Exhibit Displayed at Peruvian Fair

By M. F. Trice

INDUSTRIAL HYGIENE in the Western Hemisphere had its most southerly coming-out party in Peru at the October fair. Its debut was made in the Ministry of Health Building, one of several colorful Governmental structures built in a quadrangle around a mirror pool of water. This affair was implemented by two exhibit cases that were set up in the section of this building devoted to cooperative work in public health that the Institute of Inter-American Affairs is carrying on jointly with the Peruvian Government.

One of the two exhibition cases displayed nine chest X-ray films in three rows of three films each. In the top row, the films from left to right represented (1) a normal chest, (2) presilicosis, grade I, (3) presilicosis, grade II; the second row presented silicosis, grades I, II, and III, respectively, all without infection; and in the third row, silicosis with infection and uncomplicated pulmonary tuberculosis.

The other exhibit case displayed at the top a framed section containing photographs of underground mine scenes in which industrial hygiene engineers were using midget impingers to collect atmospheric dust samples around drillers and muckers, and a view of workers in an underground lunch room.

In the center of this exhibit case there was displayed a section of a lung of a man who died of silicosis and complications. On either side of this lung section there were compartments in which there were respectively quartz, chert, granite, flint, shale and limestone mineral specimens, with signs indicating that all but limestone would produce silicosis if the dusts were breathed. In another space drawings were displayed depicting certain dust control measures applicable to underground work and photographs of physicians examining miners.

The industrial hygiene activity in Peru is one of several public health programs that are being carried on at present as cooperative enterprises of the Institute of Inter-American Affairs and the Ministry of Public Health and Social Assistance. The Department of Industrial Hygiene has its own building in Lima and a branch in Cerro de Pasco, a mining center at 14,200 feet elevation.

There are 23 Peruvians employed, including 5 physicians and 5 engineers. These are in addition to two industrial hygienists supplied by the Institute of Inter-American Affairs. The Institute men are Mr. A. S. Landry, formerly of New Hampshire, who is in charge of the training of men in chemical-analytical procedures, and the author, formerly of Tennessee, who directs the over-all program and is in charge of field training.

Viewing the industrial hygiene exhibit at the great October Fair in Lima are, from left to right, Hon. Harold H. Tittman, U. S. Ambassador to Peru, Congressman A. S. J. Carnahan of Missouri, chairman of the Latin American Study Mission of the U. S. Congress and, with his back to the camera, Dr. Frederick J. Wampler, Chief of Field Party in Peru, Health and Sanitation Division, Institute of Inter-American Affairs, and Director of the Servicio Cooperativo Inter-Americano de Salud Pública.—Photograph by courtesy of Richard F. Greeley, IIAA, Deputy Chief, Health and Sanitation Division, Peruvian Field Party.

Whole Man Concept—

(*Continued from page 12*)

detailed information on fundamentals of human behavior, leadership, and good employee adjustment.

Program Analysis

Undergirding all of these activities of the Caterpillar mental hygiene program is a long-term program of systematic research and statistical evaluation. The psychological tests, counseling methods, supervisor orientation in human relations, analyses of group dynamics and individual adjustment problems are all under systematic scrutiny for evaluation and improvement.

The program at present is in its infancy and exacting conclusions cannot be made at this time. However, completed research studies show definite valuable results from these psychological functions. Analyses of tests and counseling have shown real contributions to personnel problems in terms of individual cases and group functions. The most apparent valuable result of the program as developed is the increased awareness and more objective approach of supervisors to human relations problems as indicated by the supervisors' participation in the activities of the mental hygiene program.

Thus, through testing, counseling, training, controlled research studies, statistical analyses and other general psychological functions, the Caterpillar mental hygiene program, in one comprehensive plan, is aimed at the improved adjustment and development of persons at all levels of the company's organization. The psychological services, on a consulting basis, are available to all members of management as well as to all operating personnel.

COMMON SOLVENTS USED IN INDUSTRY*

Hazards and Their Control

By H. F. Schulte
Los Alamos Scientific Laboratory

ABSTRACT*

What are solvents and what are they used for? To put it rather simply, they are liquids used to put solids (or liquids or gases) into a liquid phase for such purposes as ease of transportation, facilitation of chemical reactions, separation of ingredients, cleaning, subsequent evaporation with the formation of films and crystals, and numerous other purposes.

Only the most commonly used solvents will be discussed here. The first on the list is carbon tetrachloride because it is so widely used and its attendant hazards are so widely misunderstood. Carbon tetrachloride is a highly toxic solvent, producing a wide variety of acute effects ranging from headache and nausea to death.

Trichlorethylene and tetrachlorethylene are used primarily for degreasing of metals. This is best accomplished by means of vapor type degreasing equipment which may be open and manually operated, or closed and mechanically operated.

Other chlorinated hydrocarbons include chloroform, ethylene dichloride, methyl chloride, and methylene dichloride. The last is the least toxic. In the presence of high temperature surfaces or flames, they tend to decompose, giving off a number of very irritant substances, the most dangerous of which is phosgene. Methyl bromide is another dangerous material which has been used as a fumigant and has been responsible for several deaths.

Benzol or benzene is probably the solvent best known for its toxic properties. It is an excellent solvent for a wide variety of substances, but as a result of numerous fatalities its use has declined. Toluene and xylene are usually good substitutes for benzol as they are less toxic and less volatile. If benzol must be used, adequate ventilation is essential.

Naphthas, gasoline, petroleum ether and similar materials derived from petroleum usually contain relatively small amounts of benzol and are of low toxicity. They do have a narcotic effect and are serious fire hazards in most cases.

Lacquer thinners consist principally of alcohols and esters and in some cases ketones. These include propyl, butyl, and amyl alcohols and acetates. These are substances of moderate toxicity but of strong odor. Their most common use in industry is in spray paint operations and all such operations must be provided with exhaust ventilation.

The ketones include acetone and methyl ethyl ketone. These substances are low in toxicity, but the latter has an objectionable odor in high concentrations.

Methyl alcohol finds a variety of uses as a drug intermediate, antifreeze, and cleaning solvent. It is quite toxic and has a specific effect on the optic nerve.

Aldehydes are extremely irritating materials in general and are little used as solvents in industry.

Organic esters of inorganic acids have been used recently in increasing amounts. Some of these, such as dimethyl sulfate, are extremely dangerous irritants. Others like the organic phosphates are being used as insecticides and are very dangerous to handle.

Carbon disulfide is used in large quantities only in the viscose rayon industry. It is extremely dangerous material to use both from the standpoint of health and fire hazards, and should be avoided.

Turpentine is another widely used solvent, particularly in painting operations. The extreme irritation produced by turpentine makes it necessary to provide good ventilation.

Control Measures

The control measures may be summarized as follows:

Substitution of a less toxic solvent.

Isolation which serves to limit the exposure to a relatively small group who can be provided with special control equipment.

Enclosure as by the use of mechanically operated enclosed degreasers.

Personal respiratory protection involving the use of chemical cartridge respirators, gas masks, and air or oxygen supplied masks.

General ventilation is of greatest value for the control of vapors of low toxicity and where workers are not closely associated with the vapor source.

Local exhaust ventilation operates on the principle of attempting to capture the vapor at its source or to remove relatively small quantities of concentrated vapor. An important element of this method is a well-designed hood which may be fitted to the operation. Other elements are the duct work, the air mover, and the air cleaner.

Know Your Solvents

The first thing that the industrial hygienist must know is what solvents are being used in the plant, where they are being used, and in what quantities. Close contact with the plant purchasing agent is often valuable for that purpose. Some plants have set up solvent-control committees including representatives of management, supervision, stores, and medical, safety, and purchasing departments.

Control by Air Sampling

Another control measure which is extremely important is that of frequent and regular air sampling. Well-established collection and analytical techniques have been worked out for some solvents and for certain others indicating instruments are available.

Medical Control

Medical control is the other important weapon in the control of solvent exposures. A diagnosis of occupational disease cannot be made on a basis of exposure alone. A well correlated medical and environmental investigation program is needed for the control of solvent hazards.

**This speech was given at the recent Rocky Mountain Industrial Health Conference.*

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