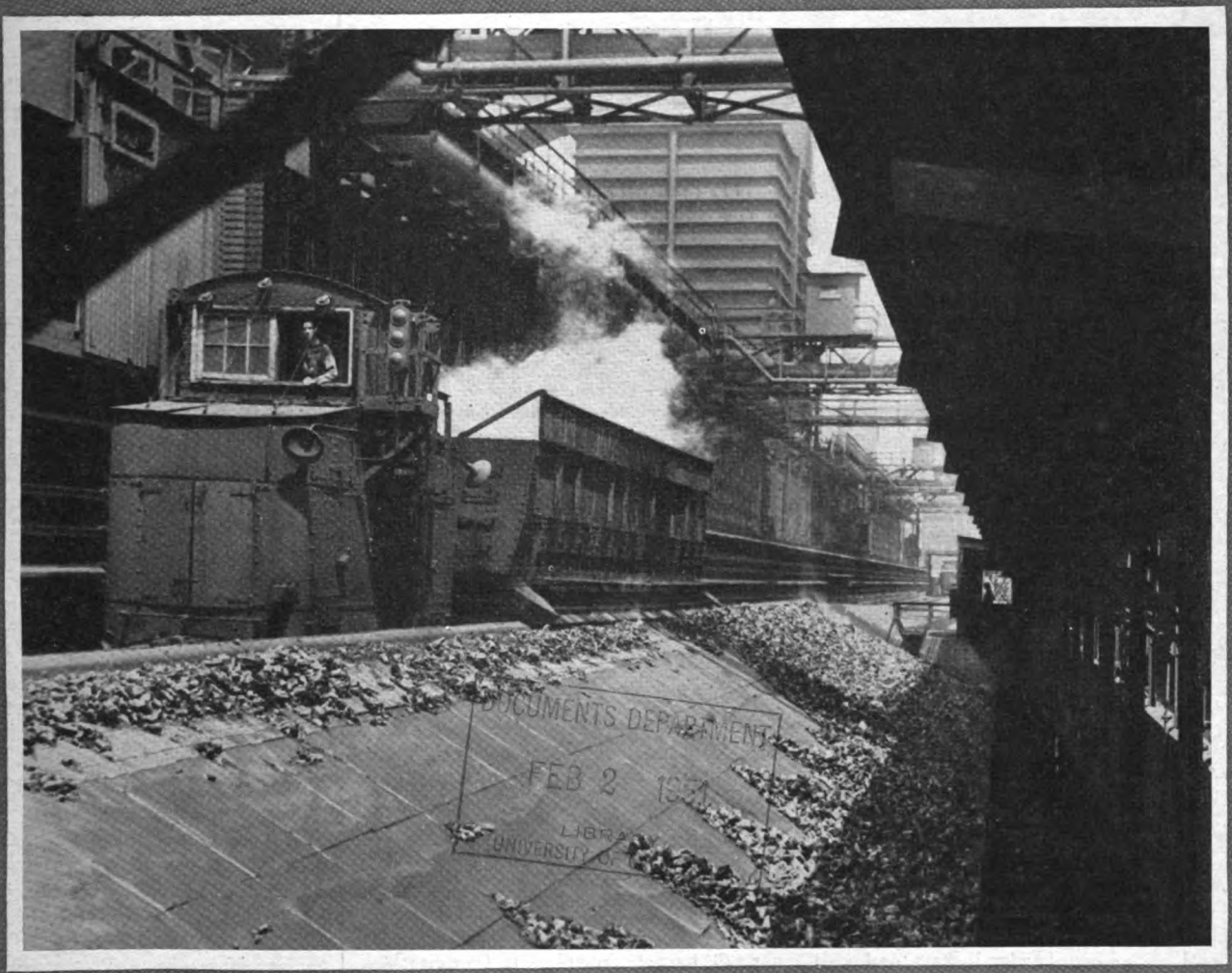
The Industrial Hygiene newsletter



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FEATURES

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Dr. A. S. Gray, Industrial Health Pioneer, Accepts New Post in Connecticut

Dr. Albert S. Gray, director of the Bureau of Industrial Hygiene of the Connecticut State Health Department, has recently been appointed to the new office of Deputy Commissioner of Health in Connecticut. Dr. Gray has been the director of the Bureau of Industrial Hygiene since 1928 and is nationally known for his pioneer work in this field.

With the assistance only of a secretary, he began his task alone to establish an industrial health bureau in this highly industrialized state. An engineer and chemist familiar with industrial processes and field work were added shortly thereafter, and a laboratory equipped. Under his able direction this bureau was one of the earliest agencies to utilize scientific methods in field investigations in industrial plants to uncover the causes of occupational disease. It has since expanded its service until at present it has a staff of about 30 people, which includes industrial chemists, engineers, and public health technicians, as well as doctors and nurses.

Dr. Gray has long believed that no plant is too small for a part-time medical program. He supported a plan which was inaugurated in April 1946, called the Hartford Plan, whereby six medium-sized plants employing between 300 and 800 persons combined their resources to support a medical service which provided for a full-time physician trained in industrial hygiene. Under this plan each plant has its own nurse, while the doctor divides his time proportionately among each of the six companies. In this way, adequate medical service is provided, comparable to that found in larger companies.

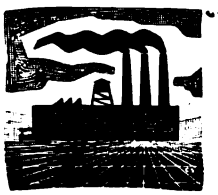
In November 1946 Yale University established the Institute of Occupational Medicine and Hygiene. Dr. Gray had urged this important enterprise and stressed the needs of more extensive education for doctors in this field.

COVER PICTURE—A small electric locomotive transfers the carload of hot coke to the quenching station where the coke is drenched with water. The coke is then dumped onto the coke wharf, thence by belt conveyor to elevated screening stations where it is sent to the blast furnaces.

Control of Noise by Education and Legislation*

By C. D. Yaffe [1]

WE HAVE heard today what effects noise produces upon man. We have also learned of practical measures whereby noise may be eliminated or at least reduced. The questions which are next up for discussion are: To what extent can we persuade people to prevent unnecessary noise? and To what extent can we make people reduce noise? There is no cut-and-dried answer to either of these questions.



The fundamental principles upon which our country was established recognize the right of the individual to live and act as he pleases, so long as he does not encroach on the rights of others. This immediately raises the question "Does a person have the right to produce unwarranted noise?" and its counterpart, "Is a person entitled to demand and get peace and quiet?" Where extreme cases are encountered there is, of course, usually little if any question. Participants engaging in a noisy altercation at 3 a. m. in a residential neighborhood would risk being arrested and charged with disturbing the peace.

There are exceptions, however. Individuals living in the vicinity of a stadium would probably be ignored if they protested against the cheers of 50,000 fans watching the home town football team trouncing its arch rival in a night game. The contest would not be postponed, either, just because a person living across the street lay critically ill, not even though that individual had objected to the change in zoning restrictions which was made to allow the construction of the stadium.

It is thus apparent that much depends upon the circumstances. In one instance the individual is denied the right to make noise. In the other case the individual is denied peace and quiet.

A similar situation of rather recent development deals with the installation of radios on buses. Should a public transportation company have the right to put radios on its buses partly for the entertainment of the passengers and partly to increase its revenue through the sale of advertising? This question has caused violent controversy. A year or two ago such an installation was made on some of the buses in Washington, D. C. Following a trial period, the Transit Commission announced that public hearings would be held in order to reach a decision as to whether to extend this "service" to all buses or to discontinue it entirely. For weeks the newspapers carried numerous letters for or against music. Citizens' committees were formed. The voteless residents of our Nation's Capital normally submit apathetically to increased bus fares, imposition of a District sales tax, or other measures of importance to their welfare or purses.

The hearings on bus music, however, brought forth the largest crowd to ever attend such an event in Washington. Despite many protests the decision was to continue and extend this "service." On the other hand, a similar experiment at Grand Central Station in New York was abandoned as a result of the criticism received. This latter decision was hailed in a *Saturday Evening Post* editorial "* * * one of the few triumphs for democracy in years."

These examples are cited because they raise another question, "What is noise?" Noise has been defined as "unwanted sound." A Bach fugue may be noise to a "jive" fan. Boogie woogie is horrible to most lovers of chamber music. In the Washington and New York situations opposite decisions were reached as to whether or not the sound was "unwanted."

Noise Ordinances

A number of cities have noise ordinances. I should like to read one which one of our major cities employs.

An ordinance to prohibit certain noises and/or sounds in * * *.

SECTION 1. *Be it ordained by the mayor and city council*, That no person, firm or corporation use or operate, or cause to be used or operated in front of or outside of any building, place or premises, nor in or through any window, doorway or opening of any building, place or premises used for commercial or advertising purposes, any device or apparatus for the amplification of the human voice or of sounds from any radio, phonograph, or other sound-making or sound reproducing device.

SEC. 2. *And be it further ordained*, That any person, firm or corporation violating the provisions of this ordinance shall be subject to a fine of not less than ten dollars ($10) and not more than twenty-five dollars ($25) for each and every offense.

Provided, however, That for public gatherings or occasions of special public interest, the mayor or the commissioner of police may issue a permit for the use of sound-making or sound-reproducing devices for limited periods of time. *Provided, further*, That nothing in this ordinance shall be construed to abridge the right of newspapers to announce, orally or otherwise, details, results or running descriptions of important news or sport events.

SEC. 3. *And be it further ordained*, That this ordinance shall take effect from the date of its passage.

For the purposes of our discussion, this is an interesting ordinance to analyze. First of all it is specifically aimed only at sound amplifying devices, and apparently only at those in fixed locations in commercial establishments. As I interpret it, there are no restrictions on sound trucks such as are commonly employed during the weeks preceding an election. Furthermore, it makes exceptions which bear out a point which I have previously made.

For comparison purposes, here is a summary of regulations in effect in another large city in the same part of the country.

IT IS AGAINST THE LAW * * *

(*1*) To sound any horn or signal device on any automobile, motorcycle, bus, street car or other vehicle while stationary except as a danger signal when an approaching vehicle is apparently

*Presented at National Noise Abatement Symposium, October 20, 1950, Armour Research Foundation, Illinois Institute of Technology.

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out of control, or, if in motion, only as a danger signal after or as brakes are being applied.

(2) To create by means of any such signal device any unreasonably loud or harsh sound.

(3) To sound any such device for an unnecessary and unreasonable period of time.

(4) To use any automobile, motorcycle, street car or vehicle so out of repair, or so loaded, as to create loud and unnecessary noise.

(5) To blow any steam whistle except to give notice of the time to begin or stop work, or as a warning of danger.

(6) To erect, demolish, alter or repair any building other than between the hours of 7 a. m. and 6 p. m. on weekdays, except in case of urgent necessity, in the interest of public safety, and then only with a permit from the commissioner of housing and buildings.

(7) To create a loud and excessive noise in loading or unloading any vehicle or by the opening and destruction of bales, boxes, etc.

(8) To use mechanical loud-speakers, or amplifiers on trucks, vehicles or outside of a building or through an open door or window, unless a permit is granted for such use, and then only in accordance with the provisions of such permit.

(9) To create any unreasonably loud, disturbing and unnecessary noise in any manner whatsoever.

(10) To create noise of such character, intensity, and duration as to be detrimental to the life or health of any individual.

(11) To operate any radio, phonograph or any musical instrument in such a manner or with such volume, as to annoy or disturb the quiet, comfort or repose of persons in any dwelling, hotel or other type of residence, particularly between the hours of 11 p. m. and 7 a. m.

(12) To use any drum, loud-speaker or device for the purpose of attracting attention by creation of noise.

(13) To keep any animal or bird which, by causing frequent or long continued noise, disturbs the comfort and repose of any person in the vicinity.

(14) To create any excessive noise on any street adjacent to any school, institution of learning, or court, while the same is in session or adjacent to any hospital, which unreasonably interferes with the operation of such institution.

(15) For peddlers, scissors grinders, etc., to shout and cry out in a manner which disturbs the peace and quiet of the neighborhood.

* * *

Traffic Noise

Certain long-range aspects must be included in any effective noise-control program. Much of our present trouble arises from lack of planning during the early development of our cities. Traffic noises, which account for a great deal of our unwanted sound, will continue to overwhelm us until our city planners provide us with relief from traffic congestion. The construction of expressways, of bypass and truck routes, the elimination of bottlenecks, and the proper synchronization of signal lights will do much to reduce the noise with which our urban areas are plagued. Farsighted zoning regulations will likewise provide protection against industrial noise. Persons interested in noise abatement should see that city planners give sufficient recognition to noise in their long-range planning.

In general, noise ordinances usually attempt to control noise from the following sources: (1) Automobile horns, (2) Construction projects, (3) Dogs and other animals and birds, (4) Steam whistles, sirens, etc., (5) Sound amplifying devices, (6) Musical instruments, and (7) Improperly maintained or overloaded vehicles.

Some of these, such as construction work, whistles or sirens and amplifiers lend themselves fairly well to simple enforcement measures. Others require educational efforts as a supplement to the law. Cooperation of the public is essential in order to achieve any degree of success. The educational program must be continuous if the purpose is to be accomplished. While special campaigns from time to time are helpful, some measures must be employed the year around, so that the public will be constantly reminded that unnecessary noise is undesirable as well as illegal.

The use of signs can be very helpful. Over many years the public has learned that a "Hospital" sign means "no horn blowing," and cooperation is obtained. Signs scattered over the city reminding the citizens of the noise ordinance should do much to help.

On a recent cross-country trip I was quite surprised and impressed to see a large sign at the city limits of one community announcing that it had a noise ordinance and that unnecessary horn blowing was forbidden. I do not know how effectively the law is enforced, but I am confident that the sign I saw has an excellent effect on strangers entering the city. If enough similar signs are so located that most citizens see at least one or two every day, many of them will get in the habit of using the brakes instead of the horn.

Noise Education Necessary

Very little has been written on the legislative and educational aspects of noise control. One pertinent reference I have found is from an article by McCord and Goodell, published in the *Journal of the American Medical Association* in 1943. They stated in part as follows:

"The control of noise by municipal or higher authority never has been wholly effective. Effectivity will never be attained until that time when both the public and responsible officials have acquired better concepts of the significance of noise and the measures by which noise may be eliminated or reduced to inoffensive levels. The vague outlawing of the barking of dogs or the shrieking of newsboys becomes unimpressive in the face of tolerated streetcar systems that may be a thousand times more annoying, or the licensing for operation of loud speakers on trucks which rove the streets day and night shouting the dubious values of possibly questionable products or causes. Legal measures as commonly written are frequently so loosely phrased as to permit numerous interpretations and hamper enforcement. Customarily, only on complaint of disturbed citizens is consideration given to obviously disturbing noises.

"Education of the public as a whole and in special groups along with necessary legislation appears to be the key to noise amelioration. Many law-abiding citizens who under no circumstances would contemplate the sending up of a rocket flare on a public street or turning a floodlight on an apartment house to attract the attention of a friend will unhesitatingly blanket a house and an entire block with resounding noise from a badly designed automobile horn. It seems necessary to carry out educative

programs as a supplement to legislative acts for the general public, for the makers or purveyors of noisy devices, and particularly for architects and builders of various structures such as homes, hotels, office buildings, and streetways."

Laws are necessary in any effective noise-control program, but it has been shown time and again that enforcement requires public support. Public backing cannot be obtained without education. Consequently, education and legislation must go hand in hand. Neither can be allowed to lag too far behind the other. If a law is passed before the public is ready to back it up, there is danger that authorities will let enforcement slide and valuable ground is lost as respect for the law disappears. On the other hand, education must be carried to its logical conclusion—legislation which insures execution of the public's wishes. Otherwise, the lessons learned are soon forgotten.

Medicolegal Aspects of Noise

In a discussion of noise control through legislation mention should be made of the medicolegal aspects and compensation problems. All states have compensation laws covering industrial injuries. Most states also award compensation for occupational diseases. Laws dealing with occupational diseases are of two general types. One is the so-called schedule type in which disability produced by specific materials or processes is compensated. To our knowledge, none of the schedule laws includes impaired hearing as a compensable disease. The other kind of occupational disease law is the blanket-coverage type in which any disability resulting from occupation is compensable. Under such laws claims have been made and compensation has been awarded for impaired hearing in a number of States. This subject was discussed by Dr. Leo Doerfler of the University of Pittsburgh at the Legal Conference of the 1949 Annual Meeting of the Industrial Hygiene Foundation. He stated, in part, as follows:

Compensation Claims

"A growing awareness on the part of workers as to the existence of acoustic trauma is reflected in an increasing number of claims involving occupational loss of hearing. The attitudes and decisions of appropriate claim commissions differ markedly in the various States, especially when one compares a highly industrialized State, with many opportunities for cases of this sort, with States which are primarily agricultural in nature.

"It appears that claims covering loss of hearing which fall under the category of injury by accident are not uncommon, and no special issue is raised, providing sufficient substantiating evidence is presented. Industrial hearing loss presumably caused or aggravated by noise presents a different problem, one which has not been raised in the majority of the States. There is the strong possibility that this type of involvement may very well fall under the definition of occupational diseases, although there is not common agreement on this point.

"In general, State laws required the total loss of hearing in one or both ears before compensation could be made, although some States allow partial compensation. The west-coast States and Texas, where shipbuilding was at a high level during the war, appear to have had the majority of claims. Several other States, notably New York, Connecticut, and Wisconsin, have had successful claims for industrial hearing loss caused by exposure to loud noise. One western State presents the ludicrous picture of allowing compensation only in the case of total hearing loss in one or both ears, in which case an extra allowance of $350 is made for the purchase of a hearing aid. Obviously, a hearing aid would be of no use in the case of a total loss of hearing."

In addition to the States which he listed, a review of reports of several industrial commissions revealed that during the past 5 years other States, including Minnesota and North Carolina, have awarded compensation for impairment of hearing. As a result industry is becoming aware that, while it yet may not have to control noise, it will have to pay for injury resulting as a consequence.

Few, if any, of the State industrial hygiene regulations or codes have provisions specifically dealing with noise. One reason for this is the scarcity of quantitative data upon which reasonable regulations may be drawn. Noise affects hearing but the precise relationships between sound levels, duration, and characteristics of noises and physiological and psychological effects remain to be established.

Nevertheless, industry is becoming convinced that noise control increases efficiency and productivity and probably decreases absenteeism by reducing fatigue and nervous strain. A long educational effort has been required to obtain this kind of thinking. Credit for the accomplishment must be shared by many groups—noise abatement organizations, consulting engineers, industrial physicians and educational institutions. If I may be forgiven for a little horn blowing at a noise-abatement meeting, I wish to include the official industrial hygiene agencies, local, State, and Federal. These groups, over the years, have spread the gospel of noise abatement in industry, and, in part, are responsible for the general growing acceptance of the idea that, as far as possible, noise hazards must be removed.

The achievements so far are encouraging, but much remains to be done, particularly through education. Our legislative bodies will pass whatever laws the people demand, and our enforcement agencies will carry them out as long as public opinion supports them.

Ready Tool Kit Saves Vermont Engineers Time and Energy

We have found that our tool kit, which we always keep ready for use, saves much time in picking up tools and instruments or hunting up a maintenance man for a screw driver or wrench. It also saves the occasional ride back to the office for a forgotten gage.

Each engineer has been provided with an inexpensive metal machinists tool chest 18 by 7 by 9 inches deep with a removable tray. Each kit contains the following: Alnor Velometer and two jets, Magnehelic gage 0–8 inches, Magnehelic gage 0–24 inches, rubber tubing, hand drill, pliers, screw driver, adjustable wrench, outside calipers (6 inches), flash light, 8-foot tape, speed counter, stop watch, respirator, and safety goggles.—**Harry Ashe, Director, Industrial Hygiene Division, Vermont Department of Health, Barre, Vt.**

THE EFFECTS OF THE STEEL INDUSTRY ON ATMOSPHERIC POLLUTION IN THE CLEVELAND AREA

By H. G. Dyktor and L. N. Goldston*

IN THE FALL of 1949 a steel strike occurred which closed steel plants in the Cleveland area. This gave us an excellent opportunity to study the air pollution load with the steel industry in operation and while the steel industry was closed. In order to develop comparable and reliable data, the study was divided into two parts: (1) a study of the concentration of dust and gaseous compounds during the steel strike, and (2) a study of the concentration of dust and gaseous compounds after the resumption of work. All possible means were taken to make this investigation complete and accurate and commensurate with the existing limitations imposed by labor, time, and facilities.

The general topography of Cleveland proper is comparatively level, forming a valley between the distant low rolling hills to the east, south, west, ending abruptly on the shores of Lake Erie on the north. The Cuyahoga industrial valley is situated in the approximate center of the city of Cleveland. Natural escarpments rising abruptly and of varying elevations bound the valley on the north, east, and the west. Ageless erosion and artificial fill-ins of industrial refuse have succeeded in forming a valley that, as it traces its tortuous and narrowing way northward then westward, defies simple description.

The Cuyahoga River, following roughly, the contour of the valley, enters this area from the southwest, flows easterly and empties into Lake Erie a few miles northwest, thus describing roughly a semicircle. Lake, river, and railroad traffic feed and support metallurgical and chemical industries, refineries, and numerous lighter industries common to unrestricted industrial zones.

The identification and concentration of airborne contaminants common to Cleveland's industrial valley has been a subject of considerable debate for many years. It is the purpose of this report to render strictly objective analyses of what has been found, and in what quantities, under two distinct conditions of industrial activity.

*Commissioner and Senior Chemist, respectively, of the Division of Air Pollution Control, Cleveland, Ohio.

Survey Plans

To obtain information concerning the concentration of airborne dust and gases, an area representative of high industrial activity was selected as a test field. Preparations were made to study and evaluate, objectively, the concentration of substances emitted from the Cuyahoga River Valley industries (1) during the steel strike and (2) after resumption of normal operations. For adequate representation, the major valley section selected for study was further divided into two minor parts: (1) North Valley, and (2) South Valley. Four stations were established in each minor area and four in the major area.

The routine sampling time was four hours per station, each of the four stations making a change of absorbers on the hour and at approximately the same time. Thus eight samples were taken by each station per day, or a total of 32 samples per day. Eight days were devoted to sampling the atmosphere during the strike period, yielding 146 samples for sulfur dioxide determinations and 112 for fluorides. During the poststrike period, 9 days were devoted to sampling, resulting in 144 sulfur dioxide and 144 fluoride samples. Five hundred and forty-six samples were taken in all. Two 3-minute filter disk samples of suspended dusts were taken at each station daily during both periods of investigation, or a total of 120 disks for shade number determination.

Sampling Methods

A biweekly sampling cycle of 4 consecutive hours per day was routinely adhered to during the survey. Thirty-four hours were devoted to sampling the atmosphere for (1) sulfur dioxide, (2) fluorides, and (3) dusts during the steel-strike period; and 36 hours of sampling for the above effluents during the poststrike period.

The gaseous compounds enumerated have been intensively investigated for several years, and their significance evaluated. Thus, the information gained through analyses of airborne effluents indicated that but two compounds are of apparent importance as major nuisances. Both sulfur dioxide and fluorides are common to coal, metallurgical, and chemical processes. These are added to the atmosphere throughout the year with a proportional increase coincident with commercial and seasonal demand and exist in measurable quantities. A mobile unit traversed the areas taking periodic samples of suspended dusts on filter paper disks. The sampling method and field procedures can be divided into two categories: (a) gas sampling and (b) dust sampling.

Sampling Procedures

The equipment was set up at selected stations with two impingers connected in parallel to a common vacuum line. One impinger of the pair was for fluoride adsorption and the second for sulfur dioxide. The air flow through the impingers was regulated by means of a bypass and the flow was observed with a rotometer. One-hour samples were taken during which observations were made of wind direction, velocity, temperature, visibility, and identifiable odors.

NOTE.—A brief outline of the analytical procedures used in this study will be printed in the next issue of the *Newsletter*.

Meteorology

Meteorological data concurrent with sampling hours were obtained from the Cleveland Airport Meteorological Station and DuPont Chemical Co. in the Cuyahoga Valley. Space in this report does not permit showing the influence that wind direction and velocity play on the contaminants.

Conclusion

Five hundred forty-six air samples of 1 hour's duration were taken and analyzed and 120 filter disks were used for the determination of shade numbers,

i. e., the soiling effect of airborne dust. Sulfur dioxide during the steel strike ranged from 0 to 0.389, but only one sample was in the range of 0.290 to 0.389 parts per million parts of air in the southern area of the valley. After the steel strike, the range was from 0 to 0.489, but again only one sample was in the range of 0.390 to 0.489 parts per million in the northern area of the valley.

The mean sulfur dioxide concentration for the strike period was 0.034 p. p. m. and for the poststrike period 0.050 p. p. m. This increase is not significant. Fluorides during the steel strike ranged from 0 to 50.0 micrograms or over, and there were six samples of over 50.0 micrograms per cubic meter of air in the southern area of the valley.

After the steel strike, the range was from 0 to 50.0 micrograms or over, and there were four samples of over 50.0 micrograms per cubic meter, again in the southern part of the valley. The mean fluoride concentration for the strike period was 11.59 and for the poststrike period 11.12 micrograms per cubic meter of air.

While the foregoing two contaminants do not seem to have been much affected by the absence or the presence of the steel-making activities, yet the latter had an appreciable effect on the soiling value of the airborne dust. Based on a necessarily arbitrary unit, the over-all soiling range during the poststrike period was roughly 50 percent greater than during the strike. There is no doubt that the emissions of iron oxide and carbonaceous matter made their substantial contribution to the soiling effect of airborne dust, especially in the northern half of the valley.

NOTE.—The reader will recognize that the authors use as a criterion for air pollution in connection with the steel industry the presence of fluorides and sulfur dioxide.—Publications Board, Division of Industrial Hygiene, PHS.

ERROR NOTED

In the December 1950 issue of the *Newsletter* the name of Paul Scharrenberg, Director of Industrial Relations, State of California, was inadvertently omitted from the list of members of the National Advisory Committee on Industrial Hygiene to the Public Health Service.

Cooperative Study of Air Pollution Under Way in West Virginia City

A RATHER unique approach to ascertaining the extent of an air pollution problem and what can be done to help solve the problem is being tried in the Charleston, W. Va., metropolitan area.

Two years ago, industry in West Virginia was faced with somewhat drastic legislation to control atmospheric pollution throughout the State. The legislation, proposed by a State-wide citizens' committee would have placed the authority and responsibility for the study and control of atmospheric pollution in the State Health Department's bureau of industrial hygiene. Industry asked for a chance to try and solve the problem by cooperative means and for more time to consider the legislative aspects of the problem. The "air pollution" bill finally, after passing the house of delegates, was not reported out of committee in the senate.

In January 1950, a group of some 15 industries in the Kanawha Valley called upon the State department of health for suggestions as to the best approach to investigation of the problem which would meet with the support of the general public involved.

Several possibilities were considered, such as the industries conducting the surveys and reporting to the public, or for the industries to employ outside technical agencies to carry out the studies and report to the public. While the industrial hygiene bureau of the health department was devoting some time to such studies, it was believed that this study would involve much more than the present staff was physically capable of performing.

The health department, after considerable study, proposed that the industrial hygiene bureau would be willing to undertake the direction of such studies and assign at least one engineer full time to the work, provided the industries involved would place sufficient funds in the State health department budget for the employment of two technical employees, clerical assistance and supplies, and the services of an outside technical agency which would conduct technical studies under the supervision of the industrial hygiene bureau to supplement the work of the bureau.

Following this suggestion of the health department a citizens' committee was appointed by the mayors of the various cities and towns involved to work with the health department and the industries in order that the work being done, and the scope of the work, would meet with the general approval of the public involved. Much of the actual work of the citizens' committee to date has been due to the constant efforts of a working 7-member subcommittee of the 33-member general committee.

Original plans called for a full year's survey involving engineering, chemical, and meteorological studies. No research into the health aspects of the problem was contemplated for this short period of time. Due to the lack of meteorological facilities and the cost involved, this phase of the study at the request of industry was deleted from the original plans.

Finally, after 8 months of planning, negotiation, and the inevitable delay associated with three such groups planning a new approach to such a problem, arrangements have now been completed for beginning this cooperative study. Some of the principal features of the plan are as follows:

(*1*) The industrial hygiene bureau of the West Virginia Department of Health will undertake the technical supervision and planning of the over-all survey.

(*2*) One technical employee of the bureau will be assigned full time to the study with laboratory services and other facilities of the bureau also being provided.

(*3*) The area of the survey will extend from Nitro to a point above Cabin Creek, W. Va., a distance of approximately 25 miles.

(*4*) The major industries in this area will provide up to $27,000 for the employment of personnel, two technical and one clerical, for travel, etc., and for the service of the Kettering Laboratory of Applied Physiology, Cincinnati, Ohio. This will supplement the work done by the bureau personnel.

(*5*) The financing of the survey by industries will extend to July 1, 1951, with plans being made by the citizen's com-

mittee to call upon the State legislature to provide funds whereby the health department can continue these studies in this area and other parts of the State over an extended period of time.

(6) The survey will include studies of the various effluents to the atmosphere from the various sources both as to quantity, nature, and physical properties and studies as to the quantities of these materials in the surrounding atmosphere.

(7) The survey will include all sources of pollution which are considered to be significant contributors to the problem. This will include industrial plants, trains, river traffic, laundries, and others.

A unique feature of the survey in this area is the fact that practically all domestic heating is from natural gas so that the problem can be considered essentially as one emanating from industrial sources.

(8) Present plans call for a closer liaison among the three participating groups, with a representative from the health department and from industry being members of the citizens' advisory committee.

It is realized by all three groups, the health department, industry, and the citizens' committee that this is only the beginning of a thorough understanding of the problem. Certainly, many of the questions cannot be answered by July 1951, when financial support from industry comes to a halt. Industry has, however, indicated its willingness to cooperate by providing the means for starting such studies.—**Submitted by the Bureau of Industrial Hygiene, W. Va. Department of Public Health, Charleston.**

Apply Now for Space in Scientific Exhibit, ACGIH Conference, Atlantic City

The Scientific Exhibits Committee is making plans for an interesting group of exhibits at the 1951 Industrial Health Conference at Atlantic City, April 21 to 28, 1951. Prizes will be awarded for the most outstanding exhibits. Applications for space in this section should be made to Allan E. Dooley, Health Division, The Texas Co., 135 East Forty-second Street, New York 17, N. Y.

FLORIDA

Air pollution.—A troublesome problem in atmospheric pollution was presented by the operation of a small lead smelter. Discarded storage battery plates were being reduced to metallic lead with a small content of antimony. The dense fumes given off in the process created a serious nuisance in a nearby housing development, as shown by the fact that the lead concentration in the smoke at a distance of 1,000 feet downwind was in excess of the maximum allowable concentration permitted in industrial operations. Executives of the company made some changes in the process when the hazard was drawn to their attention, but the nuisance persisted. The residents of the community obtained an injunction, halting the operation of the smelter until the nuisance could be corrected.

INDIANA

New quarters.—The Division of Industrial Hygiene has moved to its new quarters at 1330 West Michigan Street. This move has greatly expanded the medical, engineering, and laboratory services. Medical facilities include a modern dispensary, laboratory, and office. In the laboratory we have added a new G. E. XRD-3, an X-ray diffraction unit, and a new Baird infrared spectrophotometer.

Death from phosgene.—Through a series of unfortunate events, trichlorethylene fumes, in concentrations in excess of 5,000 parts per million, spilled over to a near-by area housing an oil stove. The heat of the stove decomposed the trichlorethylene to phosgene and produced death within 4 hours. Concentration of phosgene was 15 parts per million. Concentration of phosgene in the stove pipe was 243 parts per million. Details will be reported later.

Dermatitis from straw.—At the present we have 430 cases of dermatitis among people handling straw. The etiological factor is the straw mite—*Pediculoides ventricosus*. The mite has been recovered from the straw and classified.

This is not new, but the infection is widespread throughout the State and is producing a dermatitis in industries handling straw, particularly the straw board industry.

The mite producing the dermatitis is a parasite on either the wheat joint worm or the grain moth. Until the entomologists eradicate the two host insects the problem will not be solved. The best that can be done now to minimize the hazard is to provide workers with insect repellents and spray the straw with commercial miticides.

Specific data on our findings will be published in detail.

Personnel.—Dr. Louis W. Spolyar, having passed his American Board of Preventive Medicine examinations, is now a diplomate of this Board.

LOS ANGELES, CALIF. (CITY)

Nasatir Memorial Library.—Some thirty volumes for this basic industrial health library have been turned over to the Biomedical Library at U. C. L. A. Unexpended funds, collected for this memorial by the California Conference of Governmental Industrial Hygienists, were also transmitted for purchase of additional books from a specified list. The acting librarian of the university felt that this acquisition was most timely, since the Biomedical Library is still in the formative stage. He expressed the hope that it will be a growing reference library in industrial health and will serve as an impetus for research in industrial health in this area.

First aid.—One of the largest banking firms in the city was impressed with the articles in our *Industrial Health News* (September and October 1950) on the importance of first-aid training for personnel in industry and business firms as a fundamental of civil defense preparedness. Advice was sought in setting up a program of first-aid training and first-aid facilities for the more than 200 branch banks. We suggested that one or two persons in each branch be taught the standard Red Cross first-aid course, and that basic first-aid materials be made available in each branch.

LOS ANGELES, CALIF. (COUNTY)

Mercury exposure.—Recently the Division of Industrial Hygiene was called in to do a survey of the plastics department in one of the local plants. Upon observation it was noted that the firm was using a plastic paint that contained mercury.

The plastic finds its main use as a sealer for various ducts and is applied either by spraying, dipping, or bushing. This particular operation is conducted out of doors and air tests did not reveal the presence of any harmful quantities of mercury in the worker's breathing zone.

The coated ducts are then placed in infra-red ray ovens for drying and baking. This point in the operation seems to evolve the largest quantities of mercury and our analyses indicated concentrations of from 0.03 to 0.06 mg. of mercury per cubic meter of air, in and around the ovens.

In this particular case, the use of the plastic is quite sporadic and limited in volume. The company was informed of the hazards of mercury and that any further increase in the production of this item would of necessity require them to institute proper control measures.—**Submitted by Herbert S. Dankman and William V. Cardillo.**

MASSACHUSETTS

Defense institute.—New hazards created by the atomic age was the subject of a recent all-day discussion at an institute on civil defense and occupational health hazards held in Lowell at the State Teachers College.

The Merrimack Valley Industrial Nurses Club sponsored this Institute.

Radiation cataracts, blood disorders, skin damage, malignant growths, sterility, and possible genetic effects were designated by Doctor Harriet L. Hardy as resulting from severe radiation exposure. Doctor Hardy is Director of the Occupational Medical Clinic, Massachusetts General Hospital, and Assistant Director in Charge of Occupational Medical Service, Massachusetts Institute of Technology.

Today people engaged as luminous-dial painters using radioactive materials or as operators of machines to which radioactive electrostatic eliminators are attached are exposed to radium. Doctors and technicians and their patients are often exposed to excessive dosages of X-rays during diagnostic and therapeutic work. Shoe salesmen using fluoroscopic X-ray shoe-fitting machines may also receive excessive exposures to X-radiation. In these situations, Dr. Hardy urged medical control by obtaining the exposure history for diagnosis, knowledge of previous onsets, and hematologic studies.

SOUTH CAROLINA

Conferences.—South Carolina industrial nurses met in Columbia recently to attend the thirteenth annual meeting of the South Carolina State-wide Safety Conference.

The South Carolina State Industrial Nurses held their annual meeting in conjunction with all other nursing organizations in Columbia, S. C. Mrs. Gladys Dundore, executive secretary of the American Association of Industrial Nurses, was the guest speaker and made an excellent presentation on "Integration," stressing the need for management, the physician and the nurse to act as a team working with all official and nonofficial agencies for the development of a well-rounded industrial health program for both an in-plant and community service.

TEXAS

San Antonio survey.—Manufacturing activities of San Antonio, Tex., are carried on primarily in very small plants, employing a total of 19,600 people, according to a recent survey made as an initial step in the establishment of an industrial hygiene service in the city.

In cooperation with the Industrial Hygiene Division of the Texas State Department of Health, the San Antonio City Health Department made two complete plant studies, one of the granite and marble monument works and one of the X-ray shoe-fitting machines in the city.

As a result of this work, retail and manufacturing concerns are becoming acquainted with the industrial health program and are beginning to request advice and help with many problems.

WEST VIRGINIA

X-ray shoe-fitting machines.—Of the approximately 70 machines in the State, 40 have been checked to date, and only 3 have been found which meet all the requirements of the regulations.

Six of the 40 machines do not have excessive radiation, but do not meet the requirements of the regulations as regards timing devices and 3-intensity control. One very old machine was found to have no shielding at all around the X-ray tube, and the X-rays produced spread freely in all directions.

Machines have been found on which the stray radiation leakage at the operator's position during a fitting was as high as 1,400 milli-roentgens per hour at the point where it passed through the operator's legs, and as high as 520 milli-roentgens per hour on top of the machine where it passed through the operator's eyes. The limit set by the regulation as being safe is 12.5 milli-roentgens per hour.

Engineers Invited To Abstract Articles

The editor of *Public Health Engineering Abstracts* has extended an invitation to industrial hygienists in not only official agencies but industrial and educational institutions as well to prepare abstracts for the publication.

Anyone desiring to participate in this activity may write to Mr. W. W. Menz, 1014 Broadway, Cincinnati 2, Ohio. Mr. Menz has requested that those who prepare abstracts send them to him promptly else much of their value is lost. He also wants a list of the publications dealing with industrial hygiene which the individual receives regularly, or which are readily accessible to him.

TEXAS PREPARES FOR RADIATION HAZARDS

A NEW service has been established within the Bureau of Sanitary Engineering at the Texas State Department of Health to handle the thousands of radiation hazards an atomic bomb burst would bring.

It will perform six vital functions, all dealing with finding and decontaminating dangerous radioactive areas. They are as follows:

1. *Predisaster training program.*—Men and women will have to be trained in the use and interpretation of radioactivity-detection instruments. It is planned to start the training program immediately so as to cope with any emergency that might arise.

2. *Detection device distribution.*—These trainees will naturally need instruments to detect radioactivity and to protect themselves. Efforts will be made to supply them with such items as Geiger counters, ionization chambers, pocket chambers, and film badges— all radioactivity-detection instruments.

3. *Monitoring crews, rescue workers,* doctors, and nurses will require protective clothing, such as hoods, gloves, respirators, and coveralls, before they can go safely into contaminated areas. Clothing for this work must be secured.

4. *Field monitoring.*—Teams of radiation experts will locate areas of residual radioactivity. With the aid of Geiger counters and other detection devices, they will seek out the odorless, tasteless, and colorless radioactive particles that can burn and destroy human tissue and cause changes in body cell structure. Experts will check buildings, streams, medical supplies, food, and other vital objects that might have been contaminated. Danger zones will be marked so that people can keep out of them.

5. *Decontamination.* — Radioactivity will be destroyed by scrubbing, sandblasting, burying, and isolating the objects or areas found to be contaminated with the tricky gamma rays, and alpha and beta particles. Monitoring squads and rescue workers will have to be cleansed when they come in from the field.

6. *Exposure histories.*—The radioactivity to which emergency workers have been exposed will have to be recorded from readings on film badges and pocket chambers. Workers who get more than their "maximum allowable lifetime dose" of radioactivity will have to avoid further exposure.

Dentists Encouraged to Promote Better Dental Health Among Workers

Promotion of dental programs in industry was urged by the Council on Dental Health of the American Dental Association in a recent meeting. A resolution was passed encouraging the American Association of Industrial Dentists to do all possible to help with the establishment of dental programs in industry. They urged adoption of such programs as follows:

(*1*) Preplacement and periodic examination, including roentgenograms of all employees;

(*2*) Emergency service, including treatment of injuries and diseases of an occupational nature;

(*3*) Keeping of accurate dental records;

(*4*) Education in dental health;

(*5*) Referral of patient to private practitioner for treatment of disease of nonoccupational nature.

The American Association of Industrial Dentists is a group interested in sponsoring the study and discussion of oral health as it relates to industrial health and productivity. It promotes safety standardizing methods for the conservation or improvement of oral health among workers in industry and initiates preventive industrial dental procedures. It also promotes a more general understanding of the purposes and results of dental health care of employees. The organization encourages the development of new industrial oral health programs and promotes mutual understanding with other professional groups and industrial hygiene personnel.

Further information may be obtained by writing to the Secretary, Room 4068, Federal Security Building South, Washington 25, D. C.

Nine Tennessee Groups Represented at 2-Day Conference on Health

NINE Tennessee organizations cooperated to hold a 2-day industrial health conference recently in which physicians, dentists, nurses, chemists, engineers, industrial management, employees, and other personnel participated.

Dr. Jean S. Felton, medical director of the Oak Ridge National Laboratory, was in charge of the meeting. It opened with a panel discussion on the subject, "Can Medicine in Industry Meet the Needs of the American Worker?" Leaders in the various organizations and plants represented at the session agreed that a greater communication of ideas between labor and medicine is necessary for better industrial health programs. They agreed, too, that the problems of how to supply medical service to small plants remains unsolved. The panel was also of the opinion that an adequate mental health program in industry is lacking because so few psychiatrists have seen fit to apply their profession to industry.

During the second day of the meeting a symposium was held to discuss the services available for a health and medical program in industry. Representatives of Federal, State, and professional groups explained the services of their respective organizations.

Sponsors of the meeting were the Tennessee State Medical Association, the Tennessee section of the American Industrial Hygiene Association, and the State Department of Public Health. Cosponsors were the Tennessee Farm Bureau Federation, the Tennessee Hospital Association, the Tennessee State Nurses Association, the CIO, the AFL, and the Tennessee Manufacturers Association.

Louisville Plans Industrial Health Meeting, February 2

Speakers for the first Industrial Health Conference for the Louisville, Ky. area, planned for February 2 at the Pendennis Club, include Dr. E. C. Holmblad, Mrs. Gladys L. Dundore, R. N., Mr. Kenneth M. Morse and Mr. C. L. Schwyhart.

CULPRITS in Industry

Kentucky Reports Unusual Case of Arsine Poisoning

A SOLUTION of arsenic trichloride and hydrochloric acid was purchased for the purpose of cleaning encrustation from the bottom of an old oil well. The purchaser filled 50 gallon steel drums with this solution, and, completely ignorant of the danger involved, instructed his men to pump the solution into a pipe running to the bottom of the well. Twenty-five gallons of solution were pumped into the pipe containing the galvanized iron sections and allowed to stand overnight, with the pipe capped.

The next morning the solution was pumped from the bottom of the well and allowed to drain down the hillside. The total operation of uncapping the pipe and pumping off the liquid required about 15 minutes, during which time the operator was exposed to the fumes evolved. Forty-five minutes later the operator was seized by severe stomach cramps and passed blood in his urine. He was taken to a hospital as soon as possible and found to have the symptoms of arsine poisoning. Severe hemoglobinuria with pronounced kidney damage was evident. While the patient was saved, permanent kidney damage was probably sustained.

An investigation into the manufacture and sale of this solution revealed that the arsenic trichloride, bought from government surplus as a cheap supply of hydrochloric acid, was diluted with water to 17 percent arsenic trichloride. Hydrochloric acid produced by the ensuing action was the active ingredient in cleaning away encrustation. The hydrochloric acid, also acting upon the zinc of the galvanized pipe, released hydrogen with the formation of arsine gas.

The manufacturer was fully informed of the dangers involved in both the processing and indiscriminate sale of this solution to uninformed purchasers. Proper operational controls have been required before further production can take place. Complete information to purchasers concerning the toxic dangers involved in the use of this solution has been stipulated as a prerequisite to all future sales.—**Submitted by the Division of Industrial Health, Kentucky Department of Health.**

Metal Coating on Bolts Causes Workers' Illness

By George M. Hama*

AN electrical equipment company engaged in the manufacture of switch boxes, fuse boxes, and similar supplies requested help from the Detroit Bureau of Industrial Hygiene in determining the cause of complaint of illness among certain of its employees.

It was found that certain of the workers who were arc welding galvanized sheet metal switch boxes complained of symptoms of illness that had not been noted before. These symptoms were irritation of the nose and throat, headache, and a general feeling of not being well.

Several of the workers had been employed at this operation for a number of years with no previous symptoms of ill health. An inspection of the premises revealed that the operation in question consisted of welding the seams of galvanized sheet metal boxes and, also, welding a number of mounting bolts into the boxes.

The illness of the workers was puzzling because the operation had been inspected previously by the Bureau of Industrial Hygiene, and air determinations had indicated that the workers were exposed to concentrations of iron oxide and zinc oxide which were below the maximum allowable concentrations for these materials.

The management stated that to the best of its knowledge there had been no substitution of materials in this process since the time of the air determinations. Inspection revealed that the general ventilation conditions were unchanged. Also, it appeared from a visual observation that the fume concentration had not increased. However, it was noted that a condition somewhat irritating to the nose and throat was present that had not been noted before.

When the engineers inspected the welding operation, they noted that the white fume resulting from arc welding had a reddish-brown appearance in certain stages of the welding operation. On closer observation of the fume and the process, they noticed that the brownish fume occurred whenever the mounting bolts were welded into the box. On the basis of this observation, the engineers believed that a metal fume was involved in the exposure other than the usual iron oxide and zinc oxide fume. They also believed that the brownish fume occurred only when the bolts were welded into the boxes.

Therefore, it was decided to make a chemical analysis of the coating on the alleged zinc-galvanized bolts and to make air determinations in the welders' breathing zone. This analysis disclosed that the bolts were not galvanized with zinc, but were plated with cadmium. The air samples were also run for cadmium. Results of these determinations indicated that the workers were exposed to concentrations of cadmium fume about 30 times the maximum allowable concentration.

The plant manager and safety engineer were informed of the findings of the Bureau of Industrial Hygiene. The plant safety engineer, in checking into the reason for the substitution of the cadmium-plated mounting bolts for the zinc-galvanized ones, found that the purchasing agent for the company had specified in the last order that either cadmium or zinc-coated mounting bolts could be used without consulting the safety engineer. The last order had resulted in cadmium-plated bolts. In all the previous orders zinc-galvanized bolts had been supplied.

The cadmium exposure was eliminated by a directive from the safety department, pointing out the hazards of cadmium and specifying that zinc-

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*Mr. Hama is an engineer with the Bureau of Industrial Hygiene, Detroit Department of Health.

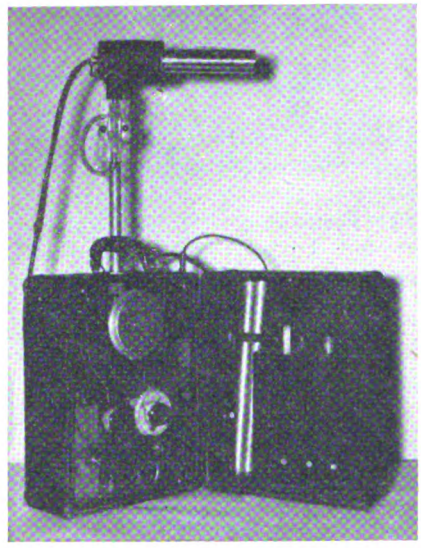
AN INEXPENSIVE FLOWMETER

Andrew D. Hosey and Herbert H. Jones*

SEVERAL months ago Bourne and Wunderle (*1*) described an orifice-variable-area meter, utilizing a "c-clamp" flowrator (Fischer & Porter Co.), for the measurement of small air flows. Applications of this metering device to the electrostatic precipitator and two types of filter paper collecting devices were described and illustrated.

The Industrial Hygiene field headquarters at Cincinnati purchased two of these flowrators, which were installed on electrostatic precipitators and used in parallel with an orifice of about one-half inch in diameter. Results were quite satisfactory and this device afforded a more accurate and practical method for measurement of air flow than other types of flow-indicating devices previously used.

Two No. 426 Visi-Float Air Filter Gages (F. W. Dwyer Manufacturing Co., Chicago, Ill.)—a type of rotameter—were recently purchased to determine if they could be satisfactorily used to measure small air flows. The Visi-Float cost $4.60 and was designed for



use on commercial and domestic air-conditioning installations to measure the pressure differential across the filter. The gage is constructed of plastic with an aluminum mounting plate. It is small, lightweight and readily adaptable for measuring rate of air flow for many types of industrial hygiene field equipment when used in parallel with a suitable orifice plate.

The plastic tube containing the float was detached from the aluminum mounting plate and mounted on a sheet of plastic. This assembly was attached to the precipitator extension tube, between the two radius taps for the orifice plate as shown in figure 1. The orifice was reamed out to approximately one-half inch diameter so that when the air flow was calibrated at 3 c. f. m. the float rose to within one-third of the distance from the top of the plastic tube. The metal indicating marker supplied with the Visi-Float was adjusted so that the top or red mark was in line with the center of the float. The lower or green mark then indicated 2 c. f. m.

The Visi-Float gage installed as described above and calibrated against a wet-test meter gave satisfactory measurements of air flow with an error of about ±3 percent. The float remained at a fairly constant level which facilitated more accurate control of the air flow. With the proper size orifice, the Visi-Float gage can be used to measure air flow for filter paper sampling devices, Greenburg-Smith impinger, midget impinger, Cascade impactor and other field sampling equipment.

*Mr. Hosey and Mr. Jones are engineers with the Division of Industrial Hygiene, Public Health Service. They are located in the field headquarters, 1014 Broadway, Cincinnati 2, Ohio.

Reference

(*1*) Bourne, H. G. and Wunderle, J. A.: An orifice-variable-area meter for small air flow measurement. *Heating and Ventilating* **47**: No. 4 (April 1950).

(Continued from page 27)

coated bolts only should be supplied. This directive also pointed out the savings resulting from using zinc-coated bolts, with zinc priced at 23 cents a pound, as contrasted with $2 a pound for cadmium.

The extreme toxicity of cadmium fumes is well known to industrial hygienists. Because of the low volatility of cadmium, a large quantity of fume will be given off when any article plated with cadmium is heated. Workers exposed to the fume become seriously ill and may possibly die if the exposure is great enough.

Where cadmium-plated articles are welded, efficient local exhaust ventilation must be provided to remove the fumes at their source. The operation should also be checked by air determinations.

Public Health Service Makes Epidemiologic Study of Anthrax in U. S.

HUMAN anthrax of industrial origin has become of increasing importance in recent years in the United States, especially in the New England and Middle Atlantic States. A study made by the Division of Industrial Hygiene, Public Health Service, in 1950 revealed that the disease in industry originates chiefly in carpet wool, particularly in carpet wool imported from parts of Asia and North Africa and possibly the Eastern Mediterranean littoral of Southern Europe.

Human anthrax attributable to the handling of animal hair is shown to be due essentially to goat hair, particularly that originating in certain parts of Asia. In the leather industry, human anthrax is due mostly to goat skins, especially those from certain sections of Asia.

Judging from the data, Public Health Service workers believe that the prevention of industrial anthrax in this country could be best effected by control of those products imported from the geographic areas mentioned. A program for such control has been outlined in some detail.

A report of this study has been printed in full in the January 1951 issue of *The American Journal of Hygiene*. It is titled "Industrial Anthrax in the United States—An Epidemiologic Study" by S. A. Veterinarian (R) Arthur H. Wolff and Sr. Surgeon Harry Heimann, PHS.

Industrial Toxicology

By Lawrence T. Fairhall*

HYDROGEN CYANIDE AND OTHER CYANIDES

ALTHOUGH once an unusual item in commerce, hydrogen cyanide is now produced and used in this country in relatively large amounts. Its most important use is in the manufacture of acrylonitrile, which in turn is used for the production of oil-resistant rubber and plastics and for the production of methacrylate resins. It is also used in the fumigation of flour mills, ships (*1*) and foodstuffs. Cyanides have for many years been used for the extraction of gold and in a number of electroplating operations. The case hardening of steel also absorbs a certain amount of cyanides.

While data regarding cyanide production in this country are unavailable the magnitude of use of cyanides may be judged from the fact that the importation alone of sodium cyanide of the United States amounted to 67,113,000 pounds (*2*) in 1948.

In view of this extensive use of hydrogen cyanide and its salts in industry and the further fact that hydrogen cyanide is one of the most lethal poisons known, many cases of poisoning might be anticipated. In comparison with other industrial poisons, however, the number of fatalities resulting from cyanide poisoning is not great. The number of deaths by acute accidental poisoning from 1940 through 1944 was 52 according to the Mortality Analysis Branch of the National Office of Vital Statistics, Public Health Service. However, the number of deaths by suicide reported in the registration area of the United States is appalling and numbered 3,106 over the years 1930 through 1941 according to the above Office (*3*).

Hydrogen cyanide appears to act directly on cellular processes, inhibiting or destroying oxidative ability. It is for this reason that it is extensively used as a fumigant, since it kills all insects and all higher animals. It lacks bactericidal properties, however. Since it inhibits oxidative processes, thus arresting the activity of all forms of life, the cyanogen compounds are true protoplasmic poisons. Cyanide poisoning is a form of asphyxia, as internal respiration is arrested.

In handling liquid hydrogen cyanide, it is important to know that it is readily absorbed through the skin. Fifty milligrams of hydrogen cyanide injected under the skin constitute a fatal dose in man (*4*), and the lethal dose by respiration is believed to be less than this amount.

According to Henderson and Haggard (*5*), 200 to 400 parts per million of hydrogen cyanide gas are rapidly fatal after exposure of 30 minutes. The maximum allowable concentration for prolonged exposure is 10 parts per million. The latter figure was adopted by the American Conference of Governmental Industrial Hygienists for the threshold limit value for 1950 (*6*), while dust or fume concentration of cyanides was established at 5 milligrams (as CN) per cubic meter.

Since hydrogen cyanide is rapidly absorbed from the lungs, symptoms of poisoning occur very quickly. An exposed individual may notice headache, dizziness, weakness, irritation of the eyes and finally, constriction of the chest. The victim rapidly loses consciousness, respiratory irregularity follows, and finally paralysis.

Two dramatic cases of cyanide poisoning were recently discussed in detail by Potter (7). Both cases recovered following prompt medical treatment. In one case some liquid hydrocyanic acid ran over the worker's hand. He became deeply unconscious after about five minutes, with stertorous breathing and flushed face. His limbs were flaccid and deep reflexes were not present, except in the case of the plantar, which showed an exterior response on the left side. The pupils were dilated and equal and showed no reaction to light.

Amyl nitrite was administered by inhalation but his condition became rapidly worse, respirations were stertorous and of Cheyne-Stokes variety, the pulse rate increased to 140 and became thready and the face showed a greyish pallor with some cyanosis of mucous membranes.

Sodium nitrate solution was injected intravenously, followed by similar injection of sodium thiosulfate. Five minutes after completing the injection therapy the patient began to move his arms and legs and muttered incoherently. His respiration returned to normal, his pulse rate dropped to 90 and the rhythm was irregular. After attacks of vomiting he felt better and wanted to sit up.

He was transferred by ambulance to a hospital and a few hours later stated that he felt perfectly well. A second case of exposure to hydrogen cyanide—apparently by inhalation—was similarly treated and recovered. Potter has discussed nitrite-thiosulfate therapy in detail and stresses the necessity for speed in diagnosis and treatment. His review of his cases of hydrogen cyanide poisoning will be of interest to all industrial hygienists and plant physicians who are concerned with hydrogen cyanide or its salts.

The human organism is not capable of detoxifying quantities of hydrocyanic acid much in excess of amounts which occur naturally in foodstuffs. However, nearly all animal tissues contain the enzyme rhodanese, which, in the presence of thiosulfate, is specific for hydrocyanic acid converting it rapidly to thiocyanic acid which is practically nontoxic.

The intravenous injection of sodium nitrite followed by sodium thiosulfate appears to be more effective than the injection of either substance alone. Both substances are detoxifying agents against hydrogen cyanide when used alone, but this detoxification action is far greater when nitrite is injected first followed by thiosulfate.

According to Williams (*8*) it is likely that sodium nitrite first reacts with hemoglobin to form methemoglobin which then reacts with hydrogen cyanide to form nontoxic cyanmethemoglobin. When cyanmethemoglobin in the blood reaches various tissues, HCN is set free but is then detoxicated by thiosulfate catalysed by rhodanese.

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(*2*) U. S. Department of Commerce Trade Statistics Report 110, 1948.

(Continued on page 32)

*Dr. Fairhall is chief of the laboratory section, Division of Industrial Hygiene Field Headquarters, 1014 Broadway, Cincinnati 2, Ohio.

Studies of Health Hazards in Industry

By J. J. Bloomfield*

***This article is one of a group of lectures which Mr. Bloomfield gave to a class of physicians in Rio de Janeiro, Brazil. In view of the constant demand for basic material on industrial hygiene techniques and for practical help in this field, a number of these lectures are being printed in the* Industrial Hygiene Newsletter.**

Liquids and Fumes

EXPOSURE to and contact with various materials in the liquid state in industry may produce harmful effects on individuals. Some liquids may be absorbed through the skin, some may produce occupational cancers, and many cause dermatitis. Each of these particular actions is important, but the discussion here will be limited only to the extent of the problem and the need for continued study and application of control methods.

Absorption Through Skin

Industrial hygiene long has emphasized the respiratory tract as the chief portal of entry of industrial intoxicants. By contrast, the skin, as a portal of entry, has been relegated to an insignificant position. Devices such as masks, respirators, and helmets have been provided to protect the respiratory tract against invasion without a thought for the skin. Development of intoxications among workers well guarded against inhalation of toxic vapors and gases is increasing the consideration of skin absorption as a factor in the causation of occupational diseases.

Factors Influencing Skin Absorption

1. Sustained, profuse sweating, eventuating in an alkaline perspiration, may deprive the skin of its oily protection and facilitate skin absorption.

2. Circumstances leading to an hyperemia of the skin promote skin absorption.

3. Breaks in the integument, such as from a dermatitis or trauma, favor entry into the body. Such entry may not, however, constitute true skin sorption.

4. Fat-dissolving agents, such as naphtha, may themselves enter the body or create opportunity for other substances to find entry through the skin.

5. Friction applied to the skin, such as the inunction of mercury ointments, is conducive to skin absorption.

6. Failure to free the body of contact with materials that may enter the skin causes absorption of industrial intoxicants.

7. Naturally oily skin offers additional difficulties to the entry of some substances.

8. The younger the skin, the greater is the probability of skin sorption by that particular skin, up to the years of senility, and in the absence of skin injury.

9. Cataphoresis may thrust into the skin substances not otherwise absorbable.

Skin Absorbable Substances

The substances include aniline oil, benzene, benzine, carbon bisulfide, carbon tetrachloride, chloroform, cyanides, cyanogen compounds, dimethylaniline, some dyes, formaldehyde, gasoline, kerosene, naphtha, nitraniline, nitrobenzol, phenol, Stoddard's solvent, nitroglycerine, toluene, trichlorethylene, turpentine, xylene, and tetraethyl lead.

Despite protection for the respiratory tract, skin absorption is likely to lead to practical damage from the following substances:

1. Aniline oil and some of its closely related derivatives and compounds.

2. Tetraethyl lead.

3. Nitrobenzol and some of its closely related compounds.

4. Hydrocyanic acid, possibly including all cyanogen compounds.

5. Phenol and cresol, including some related coal tar derivatives and compounds such as picric acid.

Tetraethyl Lead Investigation

Early in 1923, lead tetraethyl began to be used in gasoline to increase its efficiency as a motor fuel. The possible danger from such wide distribution of this lead compound aroused fear on the part of those concerned with the public health, and these fears were intensified when fatal poisonings occurred in the manufacture and mixing of the concentrated tetraethyl lead itself. As a result, in 1925 the distribution of tetraethyl lead was stopped, and the sale of gasoline containing it was generally discontinued. A subsequent conference called by the Surgeon General of the United States Public Health Service considered the matter in detail, and, after analysis of all available information had been completed, it was decided that the Public Health Service should investigate the health hazard involved in the retail distribution and general use of tetraethyl lead gasoline motor fluid. This was done, and the report was presented by a seven-man committee appointed by the Surgeon General.

In accordance with the recommendations of this committee of recognized authorities in clinical medicine, physiology and industrial hygiene, the Public Health Service drew up a set of suggested regulations regarding the manufacture, distribution, and use of tetraethyl lead for adoption and enforcement by the several States. These regulations were based mainly upon the investigation by the Public Health Service. During the intervening years, these regulations have been amended periodically, with the most recent changes being made in 1946. The public health has been protected by these procedures, and the industry has been assisted in the handling of a known hazardous material.

This particular study of a substance which is readily absorbed through the skin is an excellent example of cooperative effort in the field of industrial hygiene among Federal and State governmental agencies, private universities, and private industry.

Dermatitis

The most frequent cause of occupational dermatoses in the United States is petroleum oils and grease. These substances are not necessarily more powerful skin irritants than other

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chemicals, but more workers are exposed to their action than to any other class of irritant chemicals. Practically all machine tools use cutting oils and lubricants. Next in etiologic frequency are the volatile solvents, alkalies, and materials encountered in metal plating.

In the course of his studies, Schwartz and his associates found the highest incidence of occupational dermatoses among workers engaged in the manufacture and use of resins containing formaldehyde, such as the phenolformaldehyde resins, and among workers engaged in the manufacture of chemicals and dyes.

The following are the principal factors concerned with predisposition to the action of external irritants and therefore to occupational dermatoses:

1. Race—Negroes less susceptible to coal-tar dermatitis.

2. Age—Young workers more frequently affected.

3. Sex—Women do not develop severe dermatoses as frequently as men.

4. Season of year—More prevalent in summer than in winter.

5. Perspiration—Acts as wetting agent, enabling solids to wet skin.

6. Presence of skin disease—Open skin lesions offer little resistance to action of external irritants.

7. Uncleanliness—Most important predisposing cause.

8. Allergy—Continued exposure may result in *hardening* or hyposensitization.

Although dermatoses may be caused by mechanical, physical, and chemical actions, only the last type will be considered.

Chemical causes may be divided into primary irritants and sensitizers, and each of these may again be divided into inorganic and organic groupings.

Among the primary irritants are many inorganic acids, alkalies, and salts, as well as organic acids and anhydrides which are in the liquid state when exposure is experienced in industrial operations. Aldehydes, amines, and many solvents are included.

Primary skin irritants affect the skin in one or more of the following ways:

1. Alkalies, soaps, and sulfides dissolve the keratin.

2. Organic solvents and alkaline detergents dissolve or emulsify fat and cholesterol.

3. Tanning agents and salts of heavy metals precipitate the proteins.

4. Bleaches and *per* salts are oxidizers.

5. Inorganic acids, anhydrides, and hygroscopic chemicals are dehydrators.

6. Some organic acids and sulfides are reducing agents.

7. Coal tar and petroleum are keratogenic in their action.

Discussion of clinical types of dermatitis, diagnosis of occupational dermatitis, and the technique of the patch test, is a specialized problem and will not be dealt with at this time.

Conservative estimates of an annual incidence of 30,000 cases of occupational dermatoses in the United States are now known to fall far short of the actual number. Schwartz and his group found in their examinations in factories that, any time a survey is made, more than 1 percent (sometimes 10–15 percent) of all the workers have occupational dermatoses. Of 20 million workers commonly exposed, this would give an estimate of at least 200,000. The annual loss in time from work, plus cost of medical care and compensation for occupational dermatoses, approximates $100 million annually in the United States.

Prevention

There has not been so much attention paid to the prevention of occupational dermatitis as to the prevention of occupational poisoning, despite the fact that the dermatoses account for more time lost from work than any other occupational disease. Safety engineers and others concerned apparently think that the prevention of a mere "occupational itch" is not worth much thought or effort.

The principal methods of prevention of occupational dermatitis are the following:

1. Preemployment examinations.
2. Ventilation.
3. Protective clothing.
4. Cleanliness.
5. Protective ointments.

Preemployment examinations.—Protective measures should begin in the preemployment examination when the skin of the applicant may be carefully examined and any pathological conditions recorded. Applicants with skin eruptions should not be employed in occupations in which there is a marked skin hazard; for instance, those applicants having allergic eczemas should not be exposed to such well-known sensitizing chemicals as TNT, formaldehyde and its compounds and certain intermediates in synthetic dye manufacture.

It is not advisable to make preemployment patch tests for the purpose of discovering those workers who are allergic. Very few allergies, if any, would be discovered by this method because workers are usually not allergic to chemicals with which they have had no previous contact. Hence, patch testing workers with sensitizing materials may be the means of sensitizing them.

Careful note should be made of the sites of acne lesions on applicants for work in occupations in which they are to be exposed to cutting oils, crude petroleums, and lubricants. Applicants who have dry skins should not be placed on jobs where they must immerse their hands in fluids that defat the skin, such as strong soaps, alkaline solutions, or the volatile solvents.

Ventilation. — Efficient ventilating processes are of great value in protecting the workers from industrial skin irritants. This subject will be discussed more fully in a subsequent chapter.

Protective clothing.—Properly designed protective clothing is of great value in the prevention of occupational dermatitis. Closely woven cotton fabrics that are more or less impervious to dust are frequently used to protect workers from irritant dusts such as sodium carbonate. To give efficient protection, such fabrics must be frequently cleaned. Hence, each worker should have at least two sets of work clothes so that he will have his clean set to wear while the other is being laundered.

Impervious materials, such as rubber, offer better protection against dusts than do fabrics, and they also give protection against irritant liquids. Synthetic rubbers have been found to be more resistant to alkalies and oils than natural rubbers. Some workers do not like to wear rubber clothing because it causes them to perspire excessively, and some of them are allergic to compounds in the rubber.

Leather gloves offer good protection against trauma and irritant or sensitizing solids and dusts. Leather gloves should be made of soft pliable washable

leather, such as chamois. Gloves for the protection of the hands from irritant chemicals should reach well up the forearms and should be worn under impervious sleeves fastened at the wrists so as to prevent the entrance of irritant chemicals into the gloves.

Cleanliness.—Cleanliness is by far the most important single measure for the prevention of industrial dermatoses. Cleanliness applies not only to the person but also to the worker's clothes, the machines he operates, and the room in general. More information on this topic is discussed in the lecture dealing with good housekeeping.

There are now available good industrial cleansers for the normal skin.

Protective ointments.—While protective ointments should be used only as a last resort as a preventive measure, often they are the only available measures of protection. In most occupations, the face cannot be covered by protective clothing. Often the work must be performed with bare hands. When a protective ointment is used, the worker invariably washes it off with soap and water immediately after work and so removes not only the ointment but also whatever irritants there are on the skin. This is one good reason for using ointments. There are now many good ointment formulas available.

Methods of investigation.—The same principles that are used for the investigation of occupational hazards in general are employed for the investigation of the causes of industrial dermatitis. In the case of industrial dermatitis, however, patch tests should be performed with all the allergic materials handled by those workers who have been found to be affected. In this way the worker himself is used in an effort to determine the causative agent. Control methods may be instituted on these findings.

(Continued in March issue)

Industrial Hygiene Foundation Names Walmer Director

Dr. C. Richard Walmer, medical director of the Industrial Hygiene Foundation, has been named managing director of that organization to succeed the late John F. McMahon. The announcement was made by Dr. Edward R. Weidlein, director of Mellon Institute, following action taken at a meeting of the Foundation's board of trustees. The Foundation operates under the auspices of Mellon Institute.

Dr. Walmer, who has been medical director of the Foundation and also a senior fellow of Mellon Institute since 1946, will now be an administrative fellow in the institute. He is a widely known specialist and is on the staff of three hospitals in the Pittsburgh district. Dr. Walmer also conducts courses of lectures at the University of Pittsburgh's School of Medicine and in its Graduate School of Public Health.

Milwaukee Regulates Use of X-Ray Shoe-Fitting Machines

WHEN the Milwaukee City Health Department formed a Division of Industrial Hygiene last year, one of the first comprehensive studies was that of the 80 X-ray shoe-fitting fluoroscopes in the city. The summary of this study showed that slightly over 50 percent of the machines were found to produce both excessive radiation in the foot chamber, and stray radiation above the safe level accepted by the A. E. C. Thirty-six percent of the machines complied in all respects with the New York City and A. S. A. codes, while only 17 percent could comply with the more strict city of Detroit regulations. Sixty-four percent of the machines were considered to constitute a potential health hazard to the operator, the customers, or both.

As a result of this study, an ordinance was recently passed relating to the use of X-ray shoe fitting fluoroscopes. This ordinance limits the intensity of the primary beam and also stray radiation, specifies foot chamber filters, limits the maximum exposure time, and requires a warning and instruction placard to be posted on the customer's side of the machine.

In addition, all X-ray shoe fitting fluoroscopes are required to bear a certificate of inspection by the Milwaukee Health Department. Any violators of the provisions of the ordinance are subject to a fine.—**Industrial Hygiene Division, Wisconsin State Board of Health, Madison, Wis.**

BOOK REVIEW

EYES AND INDUSTRY by Hedwig S. Kuhn, M. D., Industrial Ophthalmologist, Hammond, Ind., Second Edition. C. V. Mosby Co., St. Louis, Mo., 1950.

Dr. Kuhn has extensively revised the first edition which was formerly entitled *Industrial Ophthalmology.* The second edition has an increase of 88 pages of text and 38 illustrations. In this rapidly expanding field, much has developed since the first edition in 1944. The author has discussed most of these advances, such as the Sight Screener and the antibiotics to mention only two examples. A new chapter "Chemical Eye Injuries" will be of interest and benefit to many industrial physicians and nurses.

Most industrial physicians, nurses, and others who are interested in ophthalmology will find Dr. Kuhn's book well written, interesting, and profitable to read. The various chapters, Visual Testing in Industry, Visual Skills, Visual Standards, Corrective Programs, Industrial Eye Injuries Caused by Solid Bodies, Radiation, Chemical Eye Injuries, Eye Protection, Illumination and the Blind in Industry, adequately cover many of the important problems in the field of industrial ophthalmology.—**A. Link Koven, Division of Industrial Hygiene, Public Health Service.**

Industrial Toxicology—

(Continued from page 29)

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(*4*) Chapman, A. C.: The colorimetric estimation of hydrogen cyanide. *Analyst* 35: 469 (1910).

(*5*) Henderson, Y., and Haggard, H. W.: Noxious Gases. Reinhold Publishing Corp., New York, 1943. P. 172.

(*6*) Report of Committee on Threshold Limits, American Conference of Governmental Industrial Hygienists.

(7) Potter, A. Lloyd: The successful treatment of two recent cases of cyanide poisoning. *Brit. J. Indust. Med.* 7: 125 (July) 1950.

(*8*) Williams, R. T.: Detoxication Mechanisms. John Wiley & Sons, Inc., New York, 1947. P. 129.

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