Industrial Hygiene

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USPHS AGAIN OFFERS FELLOWSHIPS IN HEALTH EDUCATION

Fellowships leading to a master's degree in public health in the field of health education are again being offered to any qualified United States citizen between the ages of 22 and 40, the U. S. Public Health Service has announced. Funds are available through a grant from the National Foundation for Infantile Paralysis.

Candidates must hold a bachelor's degree from a recognized college or university at the time the application is filed, and must be able to meet the entrance requirements of the accredited school of public health of their choice. Proof of acceptance at such a school must be furnished before applications are submitted to the Fellowship Awards Committee for consideration. In addition to the bachelor's degree, courses in the biological sciences, sociology, and education are required. Training in public speaking, journalism, psychology, and work in public health or a related field is considered desirable.

The fellowship consists of 8 or 9 months' academic work, which begins with the fall term in 1948, and 3 months of supervised field experience in community health education activities in a local health department. The academic training includes courses in public health administration, epidemiology, public health, and school education, problems in health education, community organization, information techniques, and others.

Veterans are encouraged to apply, and will be paid the difference between their subsistence allowance under the GI bill of rights and the monthly stipend of $100 for single students or $150 for married students paid to all Fellows. Employees of State or local health departments are not eligible, since Federal grants-in-aid are provided through the States for such training.

Information and application blanks may be obtained by writing to the National Foundation for Infantile Paralysis, 120 Broadway, New York 5, N. Y.

COVER PICTURE—A pulp mill is shown in the foreground of this photograph of Berlin, N. H., one of the thriving industrial towns of the northeast area. Photo by courtesy of Brown Co.

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Hay Fever Study Reveals Little Ragweed in New Hampshire

A report of a study of the ragweed hay fever problem in New Hampshire has been published by the Division of Industrial Hygiene, New Hampshire State Health Department. The study was undertaken to determine existing conditions in the State relative to the occurrence and extent of plant growths which cause hay fever and the resulting density of pollen in the atmosphere. The report includes comprehensive data on soil types, vegetational types, topography, climatic conditions, and other factual data affecting the growth of hay fever plants. The extent of growth of ragweed plants was evaluated for each town and city and the results of the densities of airborne hay fever pollen are given for each of the 12 sampling stations where slides were exposed daily throughout the growing season. Atmospheric pollen densities were determined for all the common pollen which cause hay fever.

The report summarizes the findings of this study as follows:

1. A large percentage of the land area of the State is at such an altitude that ragweed, the principal offending plant, will not grow.
2. Approximately 81 percent of the total acreage of the State is forest, in which ragweed does not grow.
3. The various States and provinces surrounding New Hampshire, with the exception of a small part of Vermont, have little or no effect on the airborne pollen density in this State.
4. Data on airborne pollen concentrations were obtained throughout the State at 12 stations located 50 air miles apart. These data indicate that the airborne pollen concentration was not, in general, occurring in quantities sufficient to cause hay-fever symptoms, except for five locations, and at these for only short periods of time.

A reconnaissance survey of the State made to evaluate ragweed growths showed that in most areas growths were not of sufficient magnitude but that they could be controlled readily. Many localities were found to be practically free or to have very light growths in restricted areas. In other areas the growth was found to be more extensive, but no ragweed growths were found which exceeded one tenth of an acre. It is estimated that ragweed has a probable habitat of less than 2 percent of the State's area.

In respect of hay fever caused by pollens of trees, the data obtained in this study are insufficient to make an evaluation of the problem. It is expected that such data will be obtained in future studies.

Hay fever caused from the pollens of grasses may be placed in a similar growth category with ragweed hay fever. Factors such as the large forest acreage have a similar importance in reducing the incidence to grass hay fever. Haying operations will temporarily affect the pollen concentrations in air as described in the report.

Ragweed pollen concentrations in the air at the 12 sampling stations were very low, except at 5 stations for short periods of time. In general, the pollen density was greater in the southern part of the State. These data suggest that the exposure of individuals to hay-fever pollen is a local problem, namely that of individual communities, and the hay-fever patient's own immediate environment. In other words, the hay-fever pollen concentrations are not sufficient to be transported into other communities by air movement, or wind, in sufficient quantities to be detrimental to hay-fever victims. In addition, the general air in the communities studied was only slightly contaminated with pollens except as noted above.

Reconnaissance surveys showed that the growth of ragweed was high in areas of dense population and the growth decreased as the population decreased. Ragweed appears to be a civilized plant, occurring mostly in the waste areas surrounding human habitations, and is unable to compete with hardier plants in the wild. This fact is well demonstrated by this study where it was found that the northern forested and mountainous two-thirds of the State is comparatively free of ragweed. Heavily forested land, altitude, soil types, and human concentrations all affect ragweed growth.

Returns from the hay-fever questionnaire show that a few of the allergic individuals live in the same general locality where little or no pollen appeared on the sampling slides. Investigation revealed that these patients were living in dwellings where the yard, back of the garage or surrounding waste area had small local growths of ragweed. Many of these persons worked around their yards in close proximity to the ragweed, and brushed repeatedly against pollinating plants. Slight movement of the flowering plant will release thousands of pollen grains into the air in the immediate breathing zone of the individual.

Copies of this report may be obtained by writing to the Division of Industrial Hygiene, New Hampshire State Health Department, Concord, N. H.

CO Study of Busses Made in New Hampshire

A cooperative study between the Public Service Commission and the New Hampshire State Department of Health was conducted to determine if sufficient carbon monoxide gas was present in public conveyances to constitute a health hazard to the general public and the operators.

A total of 68 separate tests for carbon monoxide were made on 24 busses and 1 gasoline-powered train. The maximum allowable limit of carbon monoxide in an industrial plant is 100 parts carbon monoxide per million parts of air for an 8-hour day. This would seem to be a good standard to accept for a bus for, while it is recognized that few passengers would be riding this length of time, it is very possible for the same operator to be driving almost continuously for this period.

All tests were made with the M. S. A. colorimetric carbon monoxide tester with the exception of special tests on B. and M. T. Co. bus on which the M. S. A. battery-operated carbon monoxide indicator was used.

No concentration of the general air was found to be above the allowable limit of 100 parts carbon monoxide per million parts of air. It was noted that it is the newer busses where trouble may be expected. On old type busses no concentrations were noted. This undoubtedly results from the fact that

Continued on page 5

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Industrial Committee State Medical Society Has Been Increased

At the recent annual meeting of the New Hampshire State Medical Society the membership of the Industrial Health Committee was increased to include many of the outstanding industrial physicians located in the manufacturing areas in the State.

The committee will work in close cooperation with the Industrial Health Committee, New Hampshire Manufacturers Association, and the Division of Industrial Hygiene, New Hampshire State Health Department. Policies, procedures, and methods of the program will be discussed jointly by the organizations.

The Industrial Health Committee is urging the promotion and stimulation of industrial health and hygiene programs in industrial plants within the State.

The committee expects to prepare and distribute informative literature on this subject.

The following resolutions were adopted by the State Medical Society:

"1. That the New Hampshire State Medical Society urge all members to report known occupational diseases to the New Hampshire State Health Department as provided under chapter 132, section 1–5, New Hampshire State Public Laws.

"2. That the society include in its future program a symposium on industrial health or invite a nationally known speaker to present a subject of interest to the general practitioner on industrial health.

"3. That the society urge industry to make provisions for employing handicapped individuals providing they are not hazardous to themselves and fellow employees and are able to perform assigned duties satisfactorily.

"4. That members of the society cooperate with the Division of Industrial Hygiene, New Hampshire State Health Department, in the conduct of health evaluation surveys among industrial employees."

The committee recommends that industrial plants employing 500 or more persons employ a full-time nurse with adequate industrial training and who will work under the supervision of a physician. Smaller plants should combine together to employ a nurse who will divide her services among the individual plants. The physician and nurse should spend regular hours at the plant. In addition, the plants should provide medical dispensaries with adequate facilities and equipment.

The committee members are David W. Parker, M. D., chairman, Manchester, N. H.; Henry Almond, M. D., Ber-

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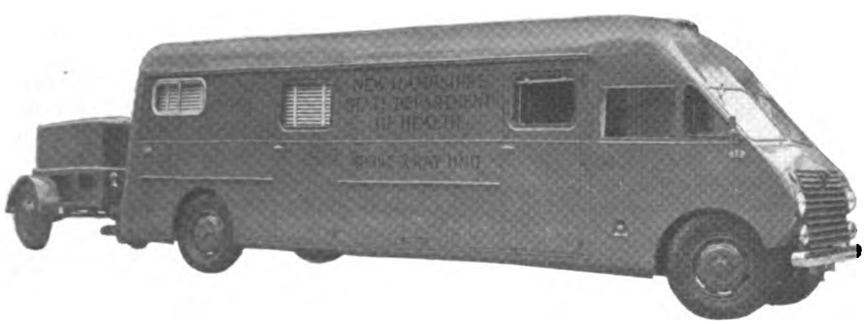
Mobile X-Ray Unit Goes to Industrial Communities in State

The Division of Industrial Hygiene, in cooperation with the Division of Communicable Diseases, New Hampshire State Health Department, is providing facilities for chest X-rays of industrial workers by means of a mobile unit shown in the photograph. The chest X-ray program is a part of the health evaluation examinations which have been conducted in the State for the past 2 years. The program is designed so that the mobile unit visits industrial plants in the community first, then the service is offered to employees' dependents, other citizens, and school children.



Formaldehyde Causes Dermatitis on Workers' Hands in Printing Plant

The Division of Industrial Hygiene, New Hampshire Department of Health, was called to investigate an outbreak of dermatitis in the mailing room of a magazine publishing plant.

Within a period of 3 days 15 girls suddenly developed a skin condition on their fingers and hands. As they had been handling these magazines for months without any trouble at all it was apparent that some peculiar circumstance of this month's publication was causing it.

The main difference between this month's cover and previous months was that they were running a three-color cover where previously they had run two colors. As they were printing one color over another it was necessary for them to eliminate the wax in the ink. By eliminating this wax the ink came off on the girls' hands as they handled the magazines.

The first thought was that the ink was causing the dermatitis. The ink manufacturer said that occasionally he had received complaints on the ink, but knew no reason why it should cause a dermatitis. Patch testing showed no symptoms, and analysis of the ink gave no reason to suspect it as the cause.

A routine test for formaldehyde showed that the cover had formaldehyde in it while tests on covers of previous months' publications released formaldehyde only after boiling action. It was thought then that a spray which is sprayed on the cover as it came off the press to dry the ink contained the chemical as a preservative. Analysis of this spray which was essentially corn starch, flour, and water, gave no evidence of formaldehyde. Tests were then run on the plain paper and formaldehyde was immediately released.

The conclusion, therefore, was that when the wax is used, it holds the formaldehyde in, but when it is not, the formaldehyde comes off easily and burns the workers' hands. Protective creams were tried and found to be adequate to prevent further trouble. All of the employees affected were under 22 years of age. Apparently the older women's hands were much tougher and they were able to work without trouble.

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St. Louis Reports Wide Interest in Third Annual X-Ray Survey

The third annual small film X-ray screening survey (conducted each year over a period of 6 months) in the industrial and commercial firms of St. Louis is almost completed. This activity is carried on by the Industrial Hygiene Section in cooperation with the St. Louis Tuberculosis and Health Society.

As a means of establishing tuberculosis control measures as a permanent phase of the plant medical program, the Industrial Hygiene Section in conjunction with the Health Centers Section of the Health Division has established a procedure whereby applicants for employment can be referred from industry to one of the Health Centers for a small film chest X-ray as a portion of the pre-employment physical examination.

During the month of January, following through on the interest created by the present tuberculosis screening survey, the physician and the nurse began making contacts with industrial management, physicians, and nurses for the purpose of acquainting them with the service they might take advantage of in adding the chest X-ray to their physical examination programs. These initial contacts have been promotional or exploratory in character, but have been received with considerable interest and a number of the plants have indicated their willingness to participate as soon as all arrangements for this service have been completed.

Committee Advises on Industrial Nursing Program of Study

The University of Pittsburgh School of Nursing has appointed a group of specialists in industrial nursing to serve as an advisory committee for their program in industrial nursing. During their first meeting they reviewed the present program at the university and studied data contributing to the planning of an improved curriculum.

Members of the committee are: Miss Mary Delehanty, supervising nurse, Equitable Life Assurance Society, New York, N. Y., and president AAIN; Miss Martha Finney, supervising nurse, Tennessee Valley Authority, Wilson Dam, Ala.; Miss F. Ruth Kahl, senior nurse officer, Chief, Nursing Section, Industrial Hygiene Division, USPHS, Washington, D. C.; Miss Katherine Lembright, industrial nursing consultant, Bureau of Industrial Hygiene, Pittsburgh, Pa.; Mrs. Bethel McGrath, author of *Nursing in Commerce and Industry*, Minneapolis, Minn.; Miss Margaret Sinnott, supervising nurse, Medical Department, Metropolitan Life Insurance Co., New York, N. Y.; Mrs. Harriet Truax, supervising nurse, Scott Paper Co., Chester, Pa.; Miss Sarah Wagner, supervising nurse, Esso Standard Oil Co. (N. J.), New York, N. Y.; and Dean Ruth Kuehn, Dr. Dorothy Rood, and Miss Glenna Walter of the School of Nursing, University of Pittsburgh.

CO STUDY—

Continued from page 3

there are so many air leaks that any fumes which may leak in are dissipated. On new busses, however, where all joints are tight, if a leak such as in the floor plates of the busses occurs, a concentration could very easily build up which might cause trouble.

The following recommendations were made:

All plates which are removed by mechanics in servicing busses should be reseated with a cork compound.

Replace all screws or bolts on plates.

Do not pry iron plates with screw drivers so that edges are bent.

Keep doors closed as much as possible when busses are idling in terminals.

All Beck-type busses, where engine cover is inside bus, should be checked periodically to be sure gasket fits perfectly.—**Stewart L. Stokes, acting director, Division of Industrial Hygiene, State of New Hampshire.**

INDUSTRIAL COMMITTEE—

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lin, N. H.; Charles F. Keeley, M. D., Claremont, N. H.; Robert J. Graves, M. D.; John Samuel Wheeler, M. D., Concord, N. H.; Daniel F. McCooey, M. D., Dover, N. H.; Robert W. Holmes, M. D., Keene, N. H.; John C. Eckels, M. D., Laconia, N. H.; Robert Flanders, M. D.; John Harold Kennard, M. D., Manchester, N. H.; Timothy Francis Rock, M. D.; and Charles Ignatius Umpa, M. D., Nashua, N. H.

Pennsylvania plants have arranged for thousands of employees to be X-rayed on the job. Very little time is lost in these fast-moving examinations and many potential hours are saved by early discovery of tuberculosis symptoms.

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Indiana Physicians Hear Dr. Townsend on Industrial Health

Addressing the Eighth District Meeting of the Indiana State Medical Association at the Delco-Remy plant, General Motors Corp., Anderson, Ind., on May 19, 1948, Dr. J. G. Townsend, chief, Industrial Hygiene Division, USPHS, told the group that private practitioners share responsibility with industrial hygiene agencies in helping industry to carry out effective health programs. Excerpts from his speech follow:

"You, as family physicians, are in a strategic position to evaluate and help maintain the health of your community. Patients come to you with symptoms varying from a minor rash to an inguinal hernia. Some of them may have looked to you since childhood, or perhaps you have pulled their babies through a bad case of whooping cough. At any rate, you're their family doctor. You have established an inimitable rapport with them. They know you, and they trust you. When they go to you with an ailment, they place a high premium on the diagnosis that you make.

"Now, wherein lies the connection with industrial hygiene? First of all, most of your patients work for a living. As workers, they come under the broad classification of industrial populations with which industrial hygiene is concerned. In the second place, you, as the examining physician, are a pivotal figure in determining how soon that worker can be returned to his job. The crux of the treatment, of course, is a correct diagnosis. Many times, however, that diagnosis may be difficult to determine, especially for the physician who has not specialized in industrial medicine.

What is your patient's job?

"Unfortunately, a general medical education does not adequately cover the consideration of the possibility of occupational disease in arriving at a diagnosis. The private physician must therefore school himself to consider the occupation of his patient in looking for diagnostic clues. If he doesn't, the patient may be treated for related non-occupational symptoms, and only by a costly trial-and-error method will it be shown that the condition is not responding to the prescribed treatment. The real cause of the ailment may be flitting about like an elusive will-o'-the-wisp—all because the possibility of occupational disease is not considered.

"Inquiry into the patient's occupation may be the divining rod which puts you on the right diagnostic track. Ulcers, as an example, may have no connection with the patient's job, and they may be of the varicose, traumatic, infectious, or malignant variety. Yet, if the patient handles or is exposed to chromium, hydrogen fluoride, bromine, or other irritant chemicals, one of those may be the guilty agent. As another instance of the advantage of a detailed occupational history, an investigation by the Public Health Service indicates that manganese poisoning may often be mistaken for multiple sclerosis or Parkinson's disease.

Study your local occupational diseases

"The symptoms of occupational diseases frequently resemble those of common illnesses. For example, many diseases resulting from toxic exposure in industrial work simulate ordinary respiratory, gastro-intestinal, and circulatory diseases at some stage of their development. One of the most common illustrations of these similarities is the resemblance between metal fume fever symptoms and those of influenza. The victim of carbon tetrachloride poisoning, who is afflicted suddenly with headache, vertigo, nausea, abdominal cramps, and weakness, may be thought to be suffering from food poisoning, unless the physician *knows* that he inhaled carbon tetrachloride fumes.

"The importance of quick recognition of the possibility of industrial poisoning is shown in a case of fatal cadmium poisoning. In this instance workers using a blowtorch to heat cadmium plated pipe became ill after 2 to 4 hours' exposure to the fumes. Vomiting, chest pains, and shortness of breath were the chief symptoms at the beginning of the illness. One worker died 4 days later of a severe chest involvement.

"In some cases the occupational disease is superimposed on an organic disease or results from a particular inability to throw off the effects of the poisoning. Serious, if not fatal, damage can occur when a person with an organic illness comes in contact with certain poisons especially affecting the diseased organs. The private physician therefore has an opportunity to prevent such an occurrence when he advises the person on types of work or living conditions to be avoided. If the patient has always been an industrial worker and expects to continue working in industry, he should be advised of the hazards which he should shun. An illustration is advising persons having a history of nephritis of the need to keep away from jobs in lead trades.

The job may not be the cause of illness

"The examples which I have cited represent cases where the cause of the malady could be laid right at the doorstep of occupational exposure. Conversely, however, all too often a man's job may be blamed without justification. It is not uncommon for a patient to insist to his family physician that his work is responsible for his malaise or other symptoms. To cite an example: a spray painter complained that as a result of his job he felt extremely weary and experienced considerable weakness. His physician immediately diagnosed the case as lead poisoning without checking into the actual exposure of the patient. As it turned out, the base used in the paint was not lead at all but contained zinc chromate.

"To err in the direction of occupational disease has other implications, too. In most States occupational illness is compensable. Classifying a nonoccupational disease as occupational therefore creates an unjust drain on compensation funds. One of the investigations of the Industrial Hygiene Division was made at the request of an insurance company that was paying a high price for occupational disease.

"A factory manufacturing cotton duck packs and parachutes was involved. The private physician consulted by the workers diagnosed all skin troubles, ranging from blackheads to serious eruptions, and all menstrual disorders, sore throats, and other minor ailments as 'pack poisoning.' Yet our

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investigation revealed that the materials used in the plant were nontoxic and absolutely harmless.

Know the plant doctors

"A diagnosis of occupational disease, therefore, must be based on sound, factual evidence. If the worker's description of his environment and the materials and processes used is too indefinite or so unfamiliar to the physician as to offer no ready clue, the physician should make immediate contact with the plant to find out the conditions to which the worker has been exposed. Employers and industrial physicians are generally cooperative in supplying the information requested. The employer, however, may not know the possibility of a hazard existing when no in-plant medical service is available. In such cases the practicing physician should verify the facts by using the resources of the official industrial hygiene service in the State government.

Report OD cases

"The physician's responsibility, however, does not end with helping his patient alone. He shares a joint responsibility with the employer and industrial hygiene agencies for the prevention of occupational diseases. These diseases often occur in the form of an epidemic, since a number of workers are equally exposed to the same conditions. Individuals will differ in their reactions to the same degree of continuous exposure to many kinds of poisoning, but it can be assumed that where one worker is afflicted, others have been or will be. It is incumbent upon the physician, therefore, to report every case of occupational disease in the same manner that he reports communicable diseases.

Cooperate with plants

"Another responsibility which the private physician shares with industry is the judicious certification of the availability and absence of workers. When a patient seeks a job in any industry using materials that may constitute a hazard to him, he should be warned against the potential risk. The physician has an equal responsibility to the employer to be as definite as possible in certifying individuals whose physical disabilities limit the kinds of work they can perform. In absence certifications the physician should discourage all attempts to use illness as an excuse for absence and should help the worker to maintain a conscientious attitude toward returning to work as soon as possible.

"When neighboring industries have inplant medical services, it behooves the private physician to have a free exchange of information with the industrial physician concerning his patient's health status. If cooperative working arrangements are not established, sometimes this dual physician-patient relationship works to the detriment of both. An unscrupulous worker may pit one physician against the other in an effort to gain his ends. For instance, it may be advantageous for a worker to have his ailment diagnosed as an occupational disease to qualify him for compensation payments. The industrial physician, however, who has expert knowledge of the conditions under which each employee works, may not feel justified in making such a diagnosis. The employee then goes to his private physician and asks him in effect to contradict the findings of the plant medical department.

"In trying to reconcile the demands of his patient and the dictates of ethical procedure, the private physician faces a delicate task. It will help his decision if he remembers that his action reflects not only on himself but also on his colleagues. The integrity of the medical profession as a whole depends in part on how he acts. Industry and labor alike scoff at the so-called '$2 letters' of certified absence. The malingering worker himself will have a healthier respect for his physician if his unorthodox request is not acceded to.

"The preplacement examination is the first encounter that the plant physician has with the new employee. This examination ferrets out the worker's limitations not with a view toward disqualifying him for employment but rather to direct him to a job which he can safely perform within those limitations. Clearly a worker with heart disease should not have a job of juggling herculean weights around. The preplacement examination, then, is a tool to fit employees into a job that will enable them to maintain their health at an optimum level.

"This initial examination is followed by periodic checks to ascertain the current condition of the employee. These checks serve to catch many incipient diseases at early stages. They not only protect the health of the worker but also spare him from the economic loss of a long illness.

Encourage family medical care

"If there is any question as to usurpation of responsibility, let me say that the functions of the plant physician *complement* rather than supplant the responsibility of the private practitioner. Actually, by making the worker aware of his health needs during the course of periodic examinations, the plant medical department acts as a referral agency. By and large, the only treatment rendered by industrial health services is the care of occupational diseases and emergency treatment for minor ailments, such as colds and gastric discomforts. The employee is encouraged to visit his family doctor to undertake any other treatment which his condition indicates.

"This greater health awareness, or health consciousness, which is created by the plant medical department, is intensified by effective educational activities. Such educational programs are an integral part of a complete plant health service. Their influence often reaches beyond the worker and percolates to his family. Once the worker is convinced of the necessity for periodic examinations and preventive care, he will encourage his wife and children to visit their family physician more often. In this light, the plant medical department serves as a valued adjunct to the private practitioner. It acts as a positive catalyst, not taking the place of the private practitioner in the physician-patient relation, but rather increasing the frequency of the interaction between the worker and his family physician."

BACK COPIES NEEDED

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A Practical Orifice Meter for Air Pumps

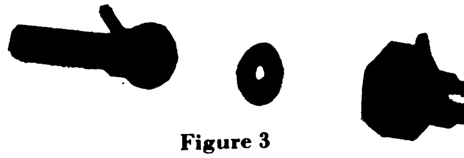

Figure 3

Robert S. McClintock [1]

In many industrial health bureaus the Willson air pump, commonly used for sampling with the Greenburg-Smith impingers, has been equipped with a Bourdon tube vacuum gage which is used to indicate the sampling rate. Due to dusty atmospheres and often necessary abuse, this gage requires frequent calibration. Individual impingers vary in their resistance when operated at one c. f. m., thus requiring individual calibration. Furthermore, since the static pressure at the pump is used as the flow indicator, variations in the sampling set-ups or sampling conditions may materially affect the indicated flow rate. Table 1 shows the variation in impingers and vacuum gages selected at random for calibration.

This table is not intended to show the basic errors involved in either the use of two Bourdon gages for static pressure measurement or in the use of static pressure as a measure for air flow. It does show, however, that the use of different impingers with the same vacuum gage will give a reading with significant error for two reasons: first, the static pressure varies significantly with the impinger, and second, the Bourdon gage is not too accurate a means of measuring the static pressure unless it is frequently calibrated.

To overcome these disadvantages, this bureau has taken advantage of the greater accuracy and flexibility of the orifice-type meter as a sampling rate indicator. This modification is more practical than heretofore because of the availability of a rugged, unbreakable manometer provided with effective surge traps. The Dwyer flexitube manometer equipped with antisurge traps is ideal for this purpose because of its plastic construction (fig. 1). The manometer is attached to the pump at a cross-junction as shown in figure 2 by a slightly modified laboratory swivel clamp which permits the manometer to be erect and level for sampling or horizontal when the carrying case is closed. Stopcocks are added to the manometer above the surge traps to prevent seepage of fluid when the pump is in transit. A button-type level is attached to the manometer as shown in figure 1 to assist in leveling. Tygon tubing is used to connect the orifice and manometer.

The orifice is constructed of one-quarter-inch brass union machined to seat against the flat orifice plate and orifice taps placed as shown in figure 3. Stainless steel is best suited for the orifice plate since it resists acid, alkali, and heat somewhat better than other materials. For one c. f. m., the orifice diameter giving a manometer reading of approximately 2-inch water gage is 0.2055-inch or a No. 5 drill size. A smaller orifice diameter is used when a lower sampling rate is required; a 0.052-inch or No. 55 drill size diameter orifice will give a manometer reading of approximately 2-inch water gage for a sampling rate of 1 liter per minute. The orifice plates are easily interchangeable in the brass union.

The above data are given only as a guide to construction, and upon completion the orifice should be calibrated for the desired air-flow rates. With ordinary usage, it is anticipated that the orifice will not wear significantly and such has been our experience to date. Calibration will be necessary at very infrequent intervals.

Calibration at various static pressures indicates that this orifice and manometer arrangement operates practically independent of resistance of sampling set-ups commonly used in industrial hygiene. The orifice possesses this advantage over the previous static pressure measurement method because it measures the pressure drop across the orifice resistance and not the static pressure of the system itself.

The pressure drop across the orifice is relatively independent of the static

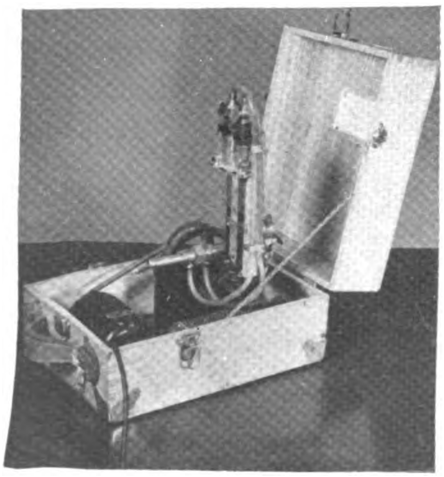

Figure 1

TABLE 1.—*Calibration of impingers*

Gage No.	Impinger [a] flow rate, c. f. m.				Dev. from 1.0 c. f. m.	
	A	B	C	D	Av. % err.	Max. % err.
1	0.968	0.868	1.015	0.948	5.8	13.2
2	0.943	0.828	0.979	0.919	8.3	17.2
3	0.988	0.866	1.017	0.957	5.3	13.4
4	0.988	0.870	1.033	0.969	5.1	13.0
	A	B	C	D		
Av. % error (from 1.0 c. f. m.)	2.8	14.2	2.2	5.2		
Max. % error from 1.0 c. f. m.)	5.7	17.2	3.3	8.1		

[a] Impingers selected at random.

[1] Bureau of Industrial Health, Michigan Department of Health.

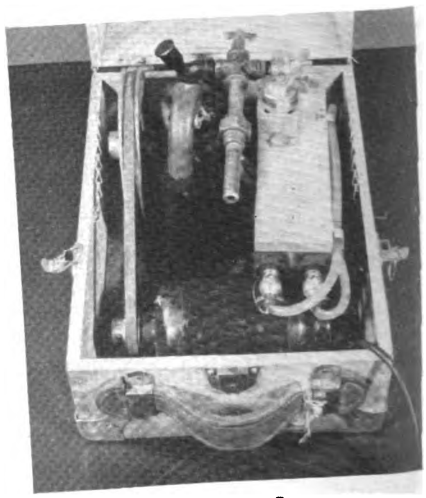

Figure 2

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pressure of the system within the ranges encountered in industrial hygiene practice; an error of 3½ percent per inch of mercury increase in static suction was noted. It would appear that this would allow a 10 percent error if the pump was used to draw air through a sampling device with very low resistance. However, this is not the case. It is necessary deliberately to impose resistance in the sampling line (such as by a screw clamp) in order to reduce the sampling volume through equipment of low resistance such as the Willson impinger, because the bypass bleeder is not adequate to reduce the sampling rate when low resistance equipment is used. Although impingers vary sufficiently in their resistance to air flow to cause error if the static pressure is used as the measurement, the variations in impingers cause no significant error when the orifice meter is used. If it is assumed that the impinger resistance can vary by 20 percent or by 0.6 inch mercury from the normal of 3 inches, this would introduce an error in the sampling rate of only 2 percent.

In summary, the advantages of this type sampling rate indicator are as follows:

It is not affected by resistance to air flow normally encountered.

It is not affected by dusty atmospheres or rough handling.

Frequent calibration is unnecessary.

Adaption to a wide range of sampling rates is easily made by changing orifice plates.

The accuracy is improved.

Carbon Monoxide in Automobile Repair Shops

To investigate[1] the extent of carbon monoxide exposures, 33 auto-repair establishments were studied in Blair County, Pa., during the winter months of 1947–48.

The investigation disclosed that the general ventilation of the majority of the garages was poor and that in only a few instances was adequate exhaust ventilation provided. Tests for carbon monoxide in the air of the workroom indicated the effectiveness of adequate exhaust ventilation where installed, for it was found that under such conditions the atmospheric concentrations of carbon monoxide were below 100 parts per million of air—the maximum safe limit for exposure to this gas during an 8-hour work day, as recommended by health authorities.

Where adequate ventilation was not supplied, the concentrations of carbon monoxide under conditions representing a peak work load were high. A man working at a distance of 3 feet from the exhaust pipe of a car with motor running was found to be exposed to 1,400 parts of carbon monoxide per million parts of air. Such an exposure could be dangerous to life after 30 minutes and perceptible effects would be noted after about 15 minutes. In several instances, concentrations of carbon monoxide in excess of 400 parts per million of air for periods over 1 hour were encountered. Such exposures are not conducive to good health and should be avoided.

The investigation also disclosed that garagemen have been attempting to minimize the physiological effects of carbon monoxide by installing ozone generators. It was learned further that these establishments installed the generators to keep the air in the building "fresh," and some of the mechanics interviewed were of the opinion that the ozone machines prevented the harmful effects resulting from exposures to carbon monoxide.

In the group studied there were 10 garages that had installed ozone generators and investigation disclosed that there was no difference in the amount of carbon monoxide in the garage when the unit was turned on or when it was turned off. Obviously, the results of the test indicate the inadequacy of the ozone units in eliminating the carbon monoxide hazard in garages, and other control measures must be adopted.

The only known effective control is to be found by the use of adequate ventilation. This may be accomplished by means of a local exhaust system, attaching a metal tube to the exhaust pipe of the car and discharging the exhaust gases out-of-doors. General room ventilation created artificially by means of powered roof ventilators or general exhaust fans, strategically located for best results, may suffice. At most, ozone generators should not be used in lieu of adequate ventilation.

[1] Pennsylvania Department of Health, Bureau of Industrial Hygiene.

KENTUCKY PUBLISHES HEALTH HAZARDS IN THE REPAIR GARAGE

Health Hazards in the Repair Garage and Their Control is the subject of a recent publication written and distributed by the Division of Industrial Hygiene, Kentucky Department of Health.

The methods of control recommended in the manual are based on the results of numerous tests and studies made in Kentucky garages.

Carbon monoxide as the number one hazard receives detailed attention. Photographs of satisfactory ventilating systems in Kentucky garages illustrate the necessary controls. Scientific explanation supports the contention.

Spray painting is another health hazard encountered by garage men that can be controlled according to the recommendations made by the Kentucky industrial hygienists. Photographs and drawings are used to show the construction of spray booths and ventilators.

To counteract lesser garage troubles, such as dermatitis, a good personal hygiene program is suggested. Precautions to be taken when degreasing tanks are operated are also listed.

Sample copies of this bulletin may be obtained from W. W. Stalker, acting director, Division of Industrial Hygiene, State Department of Health of Kentucky, 620 South Third Street, Louisville 2, Ky.

Manufacturers Appoint Health Committee

An industrial health committee was recently appointed in the New Hampshire Manufacturers Association. Members of this committee are: Mr. Charles S. Parsons, Chicopee Manufacturing Co., Manchester, N. H.; Mr. Eustace Cummings, E. Cummings Leather Co., Inc., Lebanon, N. H.; Mr. C. Henry O'Neil, Nashua Gum and Coated Paper Co., Nashua, N. H.

One of the functions of this committee is to work in cooperation with the Industrial Health Committee, New Hampshire State Medical Society, and the Division of Industrial Hygiene, New Hampshire State Health Department in matters pertaining to the health of workers in industry.

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Radiation Measuring Instruments: Their Selection and Use *

Duncan A. Holaday, USPHS

Perhaps the best introduction to a discussion of this subject is one that appears in *Radiological Defense* (*1*). The chapter on instrumentation is opened by the following paragraph: "The detection and measurement of high energy radiation depends entirely upon the proper use of suitably constructed instruments, since nature has not seen fit to provide man with senses capable of responding to it. Without instruments even intense radiation fields will not be recognized until irreparable damage has been done. It is, therefore, of the utmost importance that all persons making radiation measurements have a thorough understanding of the principles of operation and the limitations of the available instruments. Furthermore, in making radiation measurements an individual must interpret meter readings in terms of the characteristics of the specific instrument, and serious and dangerous errors can be made easily without a knowledge of the basic principles behind the instrument design."

In this discussion I shall not attempt to do more than mention very briefly the fundamental principles outlining the operation of some of the instruments which are used for measuring radiation fields. I shall list some of the situations where the industrial hygienist will find sources of high energy radiation, and shall describe the selection and use of methods of evaluating the health hazards that may exist in such locations.

Industrial Sources

At the present time natural radioactive materials are coming into widespread use in industry. Radium is being used industrially for making radiographs, for the elimination of static electricity in industrial processes, and in other instances where sources of alpha rays are useful. Polonium is also being used as a source of alpha particles. Artificial radioisotopes are not being used in industry at present; they will be encountered in institutional and industrial research laboratories in investigative work of many different kinds. The industrial use of X-rays is quite common, and high energy (1 to 2 million volts) installations are frequently encountered. X-rays are also frequently used in fluoroscopes for examining tobacco, citrus fruits, and other products, and in shoe fitting. Many of these applications present serious potential health hazards and all of them should be investigated to determine the extent of the hazards that may be created.

Ionization

Now, how are radiations detected? What is the property of these fields that enables us to discover their presence? With the exception of photographic film and a few special methods all our detecting devices depend upon the ionization caused in gases by charged particles or photons of electromagnetic radiation. It is the ability of the incident radiations to ionize matter that makes their presence known, and it is the effect of the ions they create that we measure.

Units

I do not like to define units in a general discussion, but it is necessary to have a clear concept of the meaning of these terms. I will, therefore, briefly mention a few of the fundamental units that are used for radiation, even if I am repeating material that all of you may already know.

The term roentgen has been used for many years in connection with x-gamma radiation and is a familiar unit. It is a measure of the amount of ionization produced by x-gamma rays. For biological purposes the roentgen is a very good unit because it measures a quantity in which we are interested, namely the ionizing power of the radiation field. To a physicist who is interested in the absolute intensity of a beam of gamma rays, the roentgen is a very poor unit indeed because it does not directly measure intensity. The roentgen does not depend on the time required to produce the ionization. Therefore, gamma-ray dosage rates are expressed in roentgens per unit of time, such as roentgens per hour.

When tissue ionization is produced by primary radiation other than photons, for example, by alpha rays or beta rays, the dosage cannot be expressed in roentgens. There is good evidence that, among other factors, the degree of radiation effect on tissues depends on the density of ionization along the path of the particle. Thus, one could not expect the same amount of injury from 1,000,000 electron volts of gamma ray energy as from 1,000,000 electron volts of beta ray energy.

For measuring dosages of radiation other than photons, the roentgen-equivalent-physical unit is used. This is that amount of radiation that will be absorbed in tissue to the extent of 83 ergs per gram, which is approximately equal to the energy dissipated by 1 roentgen of photons.

Studies of the relative biological effectiveness of the ionization in tissue caused by recoil nuclei produced by fast neutrons have led to the concept of the roentgen-equivalent-man. This is that amount of energy absorbed in tissue which is biologically equivalent to 1 roentgen of x-gamma radiation. If a relative biological effectiveness of 5 is assumed for fast neutrons, 1 rep. is equivalent to 0.2 rem.

The rep. and rem. units were introduced by Dr. W. H. Parker and are now widely used.

IONIZATION CHAMBER INSTRUMENTS

Ionization chamber instruments measure the amount of electrical charge collected in an ion chamber. They may be roughly divided into two broad categories according to their construction. These are: The integrating instruments which measure the total ionization produced during the time the device is exposed to radiation; and the rate-meter

*Presented at the 1948 ACGIH Boston meeting.

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type which indicates the rate at which ionization is being produced by the incident radiation. The choice of type will depend upon the source being measured.

Integrating Instruments

Integrating ionization chamber instruments must be used to measure radiation from intermittent sources. A typical example is furnished by a survey for health hazards created by X-ray, or other high energy machines. While some of these installations may be operated continuously, most of them are used intermittently. To evaluate these situations the instrument is located at the desired position and allowed to remain there for a definite time, after which the total ionization is read. The exposure in roentgens per day can then be calculated. Integrating ionization chamber instruments are usually electroscopes. Perhaps the most common representative of this type is the pencil type pocket dosimeter which is widely used. Another excellent instrument incorporates a meter which shows continuously the amount of radiation that has been received.

All of these integrating instruments are used primarily to measure x-gamma radiation. They are calibrated against standard chambers and, when used to measure energies within the wavelength ranges against which they have been calibrated, they are quite reliable. They are not useful for measuring alpha or beta ray exposures as the walls of the chamber are thick enough to stop all alpha rays and all but the most energetic beta rays.

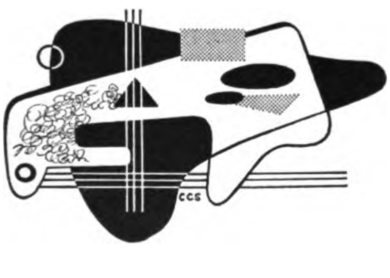
Integrating instruments can be used to measure constant radiation sources, but they are not entirely satisfactory for this purpose. The chambers must be charged, left in the radiation field for an appropriate time, and then read. For any extensive survey a large number of chambers would be needed and a long time would be required.

Rate Meter Instruments

Surveying extensive constant radiation fields requires an instrument that will give a steady deflection which is proportional to the amount of radiation striking the chamber. Several different designs of such devices are available at this time. All of the present instruments have some desirable points, so, the election of any particular one will be governed by the conditions of use. For measuring x-gamma and beta rays, it would be best to choose an instrument with a sealed ion chamber and electrical circuit. This type is not affected by dust and moisture and is quite reliable under adverse operating conditions. The instrument should have a sensitivity great enough so that a dose rate of 12.5 milli-roentgens per hour of x-gamma rays will give at least a half-scale deflection of the meter needle. These instruments are built with a relatively thin window in the ion chamber to admit beta rays, and have a shield to cover the window when a gamma reading only is desired.

Measuring photons—For measuring the ionization caused by photons, ionization chamber rate meters are reliable. Like the integrating type, the reading they give is not too dependent on the energy of the radiation, so they can be used against a wide range of wave lengths. Thus, these instruments are used for surveying continuously operated X-ray installations, or for measuring the gamma ray emission of radioisotopes. For the latter purpose they are usually calibrated against standard radium sources.

When radioisotopes which emit both beta and gamma rays are being measured, it is necessary to know the energy of the beta rays given off by the element to be sure that correct gamma readings are obtained. The beta shield that is supplied with the instruments is not heavy enough to stop the most energetic radium beta rays, for example. A shield that weighs 1.8 grams per square centimeter will stop all the betas from any commonly encountered isotope. This shield should be made of a low atomic number material such as bakelite so that it will not absorb appreciable amounts of gamma rays.



Measuring Beta Rays—When beta ray exposures are being evaluated with ionization chamber rate meters, several considerations must be kept in mind. Beta particles which are emitted by radioisotopes are not monoenergetic as are gamma rays. Instead, a whole spectrum of betas is given off, ranging from zero energy to a definite maximum value. This maximum energy will be different for each isotope. Some of the low-energy betas will not penetrate the window in the ion chamber, therefore will not be measured by the instrument. Furthermore, to obtain a true measure of the ionizing power in tissue of beta rays, all of them should expend their energy within the ion chamber. This condition is not met by survey meters equipped with air-filled ion chambers. High-energy betas will traverse the chamber completely and expend some of their energy in the walls, while soft betas that penetrate the window will lose all their energy in the chamber. For this reason, anomalous results will be obtained in measuring the ionization created by different beta emitters.

Let us clarify this point by an example: If we consider two isotopes of equivalent radioactive strength and different maximum energy betas, the element with higher energy betas will cause more tissue ionization than the one emitting lower energy betas, as all of the energy of all the particles will be expended in the body. However, if these substances are measured with a survey meter, the one with lower energy betas may very well appear to have the greater ionizing power. This misleading result is due to the characteristics of the instruments, and this fact must be mind kept inwhen surveys are made.

Measuring Alpha Particles—If an area is to be surveyed to detect contamination with alpha emitters, an ionization chamber meter is used. Instruments suitable for this purpose have a very thin window of stretched nylon film in the ion chamber which will admit the alpha particles.

Tolerances for area contamination with alpha emitters are based on alpha disintegrations per minute for a definite area. Therefore, each instrument must be calibrated against standard alpha sources before use, and the area of the window determined. With this information, locations such as hoods, benches and floors may be surveyed,

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and the extent of contamination by alpha emitters determined.

As the thin window in this meter is readily permeable to water vapor, these instruments are affected by humidity changes. They should be checked against standards at frequent intervals to be sure they are working properly.

GEIGER COUNTER SURVEY METERS

A second group of field instruments is based on the Geiger tube which has been in laboratory use for many years. Several well-designed Geiger counter survey meters are now available and are among the most sensitive devices known. These instruments operate on a different principle than ionization chamber meters, therefore have entirely different characteristics. They may be regarded as a very sensitive relay which can be tripped by a single charged particle or photon. About 98 percent of the beta particles that enter the tube are counted; but only 1 percent to 2 percent of gamma ray photons will trip the relay. The Geiger tube does not take into account the varying energies of the photons or particles, but gives equal weight to each one that it counts.

Gamma Ray Measurements

The efficiency of the counter in detecting gamma rays is dependent on the energy of the photons. This means that Geiger counter survey meters must be calibrated against standard gamma or X-ray sources, and correction factors must be used in measuring radiation of different wave lengths. Carefully calibrated standard gamma ray sources are available from the National Bureau of Standards. Calibrations for making X-ray measurements should be carried out by a well-equipped laboratory.

A further point to remember is that Geiger tubes have a definite maximum counting rate. If they are placed in radiation fields of greater intensity than this maximum, they will either indicate their top rate only, or else the tube will block and the meter needle will fall to zero. Here, again, it is important to be familiar with the behavior of the instrument with which you are working.

Beta Ray Measurements

Particular mention should be made of the behavior of G-M survey meters when they are used in the presence of beta rays. In general, Geiger tubes are about 100 times more sensitive to beta particles than they are to gamma rays, so any beta particles that enter the tube will have an effect far out of proportion to the amount present. Survey meters are equipped with a shield to absorb beta particles, but this shield is not thick enough to screen out the high energy particles from radium or potassium 42. If the shield is removed to measure the beta radiation, some of the incident beta rays will be absorbed by the window of the tube. The fraction lost will depend on the maximum range of the betas and the thickness of the window.

A correction factor could be calculated for each individual isotope, but the corrected reading of the meter still would be related to the number of betas only, and not to their ionizing ability. If the beta spectrum of the isotope is known, the average energy can be calculated, but in general the meter readings are difficult to convert into reps., and are useful only for comparison purposes. If samples of the isotopes being measured are available, G-M meters can be calibrated against ionization chamber instruments. The calibration, of course, will be no better than that of the ion chamber that is used.

Uses

I have discussed the peculiarities of G-M survey meters at some length because they are so easy to use and can give such misleading readings. Actually they are valuable devices for certain purposes, and no other instrument can replace them. G-M survey meters are about 100 times as sensitive to gamma rays as are field type ionization chamber instruments. For detecting leaks in shielding, and contamination of glassware and working areas, they are invaluable. They can be used in conjunction with probes to check water for contamination and are used for air monitoring.

PHOTOGRAPHIC DOSIMETRY

Photographic films are important tools for the measurement of radiation even though they do not have the accuracy which may be obtained in the laboratory by electrical instruments. A film is small and light, may be obtained with a wide range of sensitivity, provides a permanent record of exposure and has no complicated electronic circuits to get out of order. For many applications these considerations outweigh the disadvantages of film processing, and the inherent variations in photographic materials.

Construction And Use

Photographic radiation meters are usually made into dental film packets and covered with an opaque wrapping. Any combination of suitable emulsions may be put into one packet. Films are available covering the range from 0.05 r. to 20,000 r. with any single emulsion covering an exposure range of about 1 to 10. A cross of thin sheet lead is usually attached to the packet. This absorber will stop beta particles so the darkening under the cross will be due to gamma rays. Also a large number of electrons are ejected from the cross, thus enhancing the darkening due to gamma rays.

These films must be calibrated against radiation sources of known strength. Radium is customarily used for gamma ray calibrations, as standard samples are readily available. For use in measuring X-ray exposures, the films must be calibrated against X-rays of about the same energy as those that are being studied.

The blackness of the processed film is measured with a densitometer. The best available instrument should be used for this purpose, and the density of calibration and unknown films must be read on the same densitometer.

Processing of the films must be carried out under controlled conditions. The temperature and time of development should be as uniform as possible, and fresh chemicals should be used. Washing and fixing baths need not be controlled so closely. Needless to say, processing techniques should be identical for calibration films and for those used to measure unknown sources. Variations of about 20 percent may be expected with the best possible calibration and processing techniques.

CONCLUSION

Let us recapitulate the important points in selecting instruments.

Integrating ionization chamber instruments must be used to measure intermittent radiation sources, and may be used to measure continuous fields. Rate-meter instruments are useful to measure continuous sources, but should not be used to survey intermittent ones.

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In my opinion, for general use in surveying continuous sources, ionization chamber rate meters are preferable to those based on the Geiger tube. Ionization chamber instruments are not so dependent on the energy of the incident radiation and their readings are more readily interpreted.

For detecting low levels of radiation, such as laboratory contamination, leaks in shielding and other small sources, no other presently available instrument can replace the G-M meter. Likewise, G-M meters are used for checking water rapidly, and for other special purposes.

Very good results can be obtained with field instruments in surveying sources of x-gamma radiation, but only approximate readings can be obtained in checking beta-ray exposures.

Photographic methods are valuable adjuncts to field instruments, and it is desirable to supplement other devices with film badges.

In this presentation I have assumed that instruments will be operating as designed, and that the user will not be handicapped by any of the numerous troubles that can beset electronic devices. This is an incorrect assumption, of course. Unfortunately, if radiation measuring instruments are operating at all, the meter needles will always indicate a reading when they are placed in a radiation field. Whether this reading has any validity is another question. Therefore, in conducting a survey, it is desirable to start out with two recently calibrated instruments and to take along a source of radiation, such as a luminous button, to check their operation.

References

(1) *Radiological Defense*, Vol. I.

(2) Radioactivity Units and Standards, R. D. Evans, *Nucleonics*, 1, p. 32, Oct., 1947.

RECOMMENDED READING

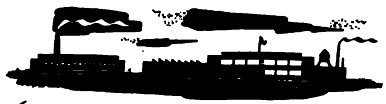
Supplement to Naval Medical Bulletin: (March-April) 1948.

This supplement is the radioisotopes number of the Naval Medical Bulletin. It contains 18 articles discussing the field of radioisotopes. Each article has been prepared by a well-known authority in a particular branch. The whole symposium is well worth study by anyone interested in the use of radioisotopes and the problems connected with them. Some articles which will be of special interest to industrial hygienists are:

(1) The Determination of Soft Radiation; (2) The Determination of Hard Radiation; (3) Hazards Presented by Radioactive Materials and How to Cope With Them; (4) Laboratory Handling of Radioactive Material; Protection of Personnel and Equipment; (5) Medical Aspects of an Atomic Disaster Plan.

Much useful information has been assembled in this issue and the reader will be well repaid for the time spent in studying this material.

Henriques, F. C. Jr., and Schreiber, A. P.: Administration and Operation of a Radiochemical Laboratory. *Nucleonics*, 2: 3 1 (March) 1948.



Los Angeles Designs Air Pump To Operate 8 Midget Impingers

The Division of Industrial Hygiene, Los Angeles County Health Department, has long felt the need for an electrically driven air pump which would combine easy portability with enough power to operate several midget impingers in parallel.

In November 1947 such an instrument was constructed by personnel of the division and has been used extensively in the field. These tests have proved so satisfactory that we feel other industrial hygienists will be interested in construction details.

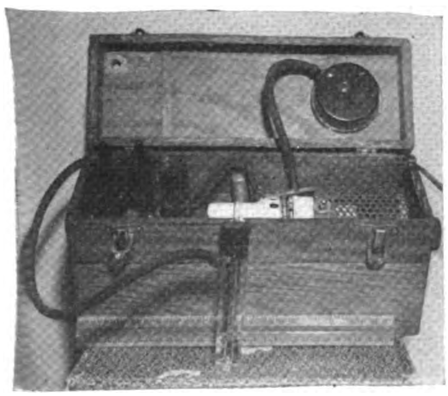
The essential parts are (1) 1 type #C-287, Jordon air and suction pump; (2) 1 type K #0452, 100 watt, 200 ohm ohmite rheostat; (3) 1 M. S. A. midget impinger vacuum gauge; (4) 8 midget impingers. Incidental parts are (1) rubber tubing; (2) brass T-tubes; (3) electric cord with line switch, and (4) carrying case. The last was constructed from a Willson Co. thermo anemometer oak case by extending the vertical sides 2 inches.

The rheostat knob is mounted outside at one end of the case near the air intake part of the pump. The rheostat itself is inside. With this particular rheostat run at full resistance a vacuum of approximately 12 inches of water is obtained on most 115-volt lines with 1 midget impinger. It has been our experience that with this arrangement the heat generated is not excessive for ordinary usage, especially if the lid of the case is left open as much as possible. With the full 200 ohms in the line, the speed of the motor is such that the operation of the pump is practically noiseless.

A pinch clamp is provided upstream of the vacuum gage to be used when the rheostat is not sufficient to reduce the vacuum to 12 inches. A midget impinger with a broken stem is used as a trap in the suction line to prevent accidentally entrained water from reaching the pump. When following a worker or operation where pinning the impinger on a man is impracticable, the impinger in use may be left in the case since a small hole has been drilled in the lid to accommodate the impinger stem.

On the many occasions arising when 110-volt power is available and midget impinger sampling is desired, this instrument has proved valuable. Once the necessary adjustments are made the hygienist is free to attend to other duties. One pump will operate several midget impingers in parallel simultaneously; it can also be used as a source of vacuum for other instruments up to about 20 liters per minute of free air.

Total weight of the instrument complete with impingers is 10 pounds, which is the factor we believe will recommend the instrument most to the field hygienist.—**Paul G. Brown, Engineer, Division of Industrial Hygiene, Los Angeles County Health Department.**



This portable air pump weighs only 10 pounds and has enough power to operate 8 midget impingers.

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LOS ANGELES, CALIF.

Carbon Tetrachloride—This solvent is attaining the unenviable reputation of leading all other organic solvents in cases of actual harm and potential injury. Probably because it was so hard to get during the war years and it has advantageous technical properties, there is a mad scramble to use it for every imaginable kind of application. Repeated warnings of the serious health hazard (even reported deaths) from its vapors pass unheeded because it does a good job of cleaning and degreasing without causing a fire hazard.

In this connection, serious vapor exposures were found this month in a fire-extinguisher plant. In one section, following the buffing of brass cases, the same workers degreased them with rags soaked in carbon tetrachloride. Because there was no local exhaust ventilation the vapor concentration was 180 p. p. m., almost four times the currently recognized maximum allowable concentration.

Nearby there was a well-designed exhaust system for keeping vapors out of the breathing zone of workers, but the blower discharged directly through the wall and an open window above the blower carried the "carbon tet" vapors right back into the room. As a result, the vapor concentration throughout the area was quite constant, although fairly low.

It was recommended that the wiping operation be done under adequate local exhaust or a nontoxic solvent used in place of the "carbon tet." To eliminate the recirculation of vapors from the existing system it was suggested that the exhaust discharge be carried above roof level.

Another use of "carbon tet" was studied during the month. At the request of the California Division of Industrial Safety, specifications for a new fumigation chamber in a large costume rental concern were reviewed. The fumigant to be used is a mixture of 25 percent carbon tetrachloride and 75 percent propylene dichloride.

Unfortunately the new chamber was partly completed so that major alterations would not have been practicable. However, management agreed to improve air circulation within the chamber along with more adequate make-up air during the purging of the chamber. Also the steam vaporizing unit would be placed inside the chamber, instead of outside as previously planned. This study proves again the importance of educating plant management to consult the Division of Industrial Health before new equipment or processes are installed.

KENTUCKY

Firebrick Dust—The control of atmospheric dust in the firebrick industry is discussed by W. W. Stalker, N. E. Schell, and R. S. Kneisel in the April, 1948 number of *Heating and Ventilating*. This article is a follow-up, progress report on three of four plants studied in 1945. The investigation at that time disclosed a positive need for dust control in certain operations and processes of the firebrick industry in Kentucky. In one plant the installation of an efficient dust-collecting system in the burnt brick grinding department made it possible to salvage enough usable grinding dust to defray the expense of the entire installation within a 2-year operating period. The authors conclude that "by concentrating upon control of the two greatest dust-producing operations, dry-pan mills and screen mills, the firebrick industry has made much progress during the last 2 years toward solving a general and potentially hazardous dust problem."

Personnel—Mr. Wilbur A. Mitchell, industrial hygienist with the division, has returned from a year of graduate study at the School of Public Health, Columbia University.

Conference—The Division of Industrial Hygiene assisted the Louisville Safety Council in cosponsoring a Kentucky Statewide Safety Conference. Special emphasis was placed on the general field of industrial safety with particular reference to industrial health and hygiene, although the conference was organized to cover all fields. Dr. Frederick W. Dershimer, chief psychiatrist with the E. I. du Pont de Nemours Co., was the principal speaker.

Personnel—Dr. Charles W. Morris, director of the medical department of the Du Pont neoprene plant of Louisville, has been employed as medical consultant to the Division of Industrial Hygiene, Kentucky State Health Department. In his capacity as special medical adviser to the staff, he will assist in occupational disease control, technical studies in toxicology and general industrial medical and nursing programs.

The most recent addition to the staff of the Division of Industrial Hygiene is Mrs. Sue Weir Vaden. Mrs. Vaden is a medical technician registered with the American Society of Clinical Pathlogists and as such will give valuable assistance to the medical and clinical aspects of the division's current program.

MASSACHUSETTS

Bulletins—The Division of Occupational Hygiene is presently preparing as part of the recommended safe practice bulletins a series of 21 respiratory protection data sheets, of which 8 have already been issued, and also 10 physical data sheets, of which 3 have been completed. It is believed that each series will provide information on the entire field it is intended to cover. An up-to-date list of publications available for distribution is now on hand, superseding the June 1946 list. Requests for any of the above will be complied with as promptly as the bulletins are made available.

Nurses—Mrs. Sarah E. Almeida, R. N., industrial nursing consultant of the Massachusetts Division of Occupational Hygiene, welcomed a group of nursing students from Simmons College who were given instruction in governmental agency relationships, a history of the development of industrial nursing and instruction in the newer field of advisory services.

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Talks to student nurses at the Milford Hospital and Faulkner Hospital were delivered by Mrs. Almeida. She pointed out differences between public health nursing by official and voluntary health agencies, and industrial nursing which serves workers and their families in the interest of preventive medicine to enhance the well-being and productivity of the worker.

MICHIGAN

Personnel—Dr. Victor C. Myers has recently rejoined the staff of the Bureau of Industrial Health, Michigan Department of Health, after a year's study at Johns Hopkins University, where he received his Master of Public Health degree.

MINNESOTA

Conference—The Division of Industrial Health participated in the meeting of the National Society for the Prevention of Blindness. A display was provided which showed what the industrial nurse can do for the prevention of blindness. Industrial nurses lent by industries from this area attended the display throughout the meeting.

Nurses—About 80 industrial nurses from the northwest area attended the sixth annual meeting of the continuation courses in industrial nursing at the University of Minnesota's Center for Continuation Study.

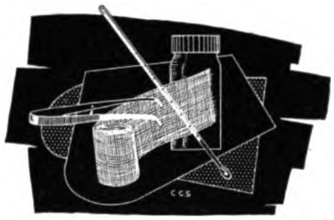
Speech—G. S. Michaelsen spoke at the Duluth Industrial Safety Forum on "The Health Hazards in Grain Handling."

Garages—A study of a number of garages is being made to determine the extent of the health hazard associated with the spraying of undercoating on automobiles. It has been found that aromatics are present in some of the products, and that atmospheric concentrations in the breathing zone of the operator are as high as 1,000 p. p. m. in some instances.

Gas Leaks—The division was called in on a unique problem involving gas leakage in a number of basements in the downtown district of Hutchinson, Minn. Explosive concentrations of the gas were found to be present in cracks in the cement floors and walls of the basements, and also in rat holes in an area which was quite remote from the piped gas lines. The odor of the gas did not greatly resemble that of the piped gas, and portions of the piping system that were uncovered showed them to be in very good condition. Gas samples were taken at many locations and when analyzed with a mass spectrometer it was shown that the gas was originating from a leak in the piping system. Further excavation uncovered a break in the pipe line and gas was evidently being conveyed to the remote areas by the tunnels provided by burrowing rats.

NEBRASKA

Nurses—A 1-day industrial nursing institute is to be held in Omaha on Saturday, September 11. This institute is being sponsored by the industrial nurses in Nebraska and the State Department of Health. Among those participating in the discussions will be Mrs. Mabelle Markee, industrial nursing consultant, USPHS. A recent survey showed 41 registered nurses employed in 21 Nebraska industries.



NEW JERSEY

Talks—Miss Agnes Anderson, industrial hygiene nursing consultant of the Division of Adult and Industrial Health, recently addressed the South Jersey Industrial Safety Council which held a joint meeting with the South Jersey Industrial Nurses Association on "The Industrial Nurse's Role in the Safety Program." Messrs. Munroe and Schall of the division gave talks to the foremen's association of a large New Jersey manufacturing plant on the subject "Industrial Hygiene Instrumentation" and "Illumination," the latter as part of the sight-conservation program of the Division. Mr. Schall also spoke to the Management Association of central Jersey on industrial hygiene.

Nurses—Nurses in the School of Public Health, Columbia University, had part of their orientation and field-observation training with personnel of the division. In addition to plant visits, they attended a division staff conference at which time the functions, duties, and services of the Industrial Hygiene Division were explained by members from each of the various sections. Other divisions of the Department of Health associated with the Division of Industrial Health in the Bureau of Preventable Diseases also participated in this project.

Bulletins—*Magnesium, Cadmium, and Carbon Tetrachloride*, are the titles respectively of Industrial Hygiene Bulletins numbers 5 to 7 of volume 2, issued by the division. Engineering controls for the use of the materials and the medical and medico-legal aspects involved are outlined. *A Medical Record System* is the title of Bulletin No. 8, which offers an excellent explanation of a practical system for maintaining records in the plant medical department. Eight objectives are stressed: confidentiality, accessibility, proper tabulation, health evaluation for job placement, indices of hazardous exposures, statistical analysis and compilation, evaluation of health services, and cooperation with outside agencies and private physicians. The benefits obtainable from the use and interpretation of the records are presented in a summary at the end of this 12-page bulletin.

Personnel—Miss Catherine Chambers, industrial nursing consultant, returned to this unit in June, upon receiving her degree at Western Reserve University, Cleveland, Ohio.

Mr. Edward J. Otterson and Mr. Walter H. Poppe, Jr., are taking a summer course in industrial hygiene at the Georgia School of Technology.

Detroit Discusses Ultraviolet Radiation Exposures From Lamps

At a meeting of representatives of the Electrical Division, city of Detroit; Bureau of Industrial Hygiene, city of Detroit; Detroit Edison Co., and a number of manufacturers of ultraviolet germicidal lamps, it was decided that some attempt should be made to control the promiscuous installation of ultraviolet ray lamps. Complaints of severe eye irritation and erythema of face and hands had been received from time to time from workers exposed to improperly installed lamps. These lamps have been found to be used extensively in meat refrigerators, bakeries, bars, and restaurants.

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It was agreed that the technical advice should be available to contractors installing these lamps. The Technical Department of the Detroit Edison Co. has developed a direct reading, portable ultraviolet radiation meter, sensitive only to the wave lengths in the region from 2000 Angström units to 3000 Angström units for checking these lamps.

The recommendations of the American Medical Association that the exposure be limited to 2.4 microwatts hours per 24 hours were felt to be safe and reasonable.

The following notice was published in the *Quarterly Bulletin* of the Bureau of Electrical Inspection, Department of Buildings and Safety Engineering, City of Detroit:

Ultraviolet Ray Germicidal Lamps

"The Bureau of Industrial Hygiene, Detroit Department of Health, comments as follows on the hazards of these lamps:

'Serious injury to the eyes may result from improperly installed ultraviolet germicidal lamps. Symptoms of excessive exposure are as follows: pain in eyes, sandy feeling in eyes, blurring of vision, difficulty of focusing eyes, headaches, and in severe cases, temporary blindness. Ultraviolet germicidal lamps are not recommended for producing sun tan on the skin. (The wave length of the rays is such that erythema is produced, rather than tanning.) Excessive skin exposure results in "sunburn", redness, severe inflammation and blistering; if redness of the skin or soreness of the eyes results from exposure to ultraviolet radiation, the use of the lamp should be discontinued until it is installed so that the worker is protected.

'The lay users of the lamps should not attempt to install the lamps themselves without the advice of the Electrical Bureau, the manufacturer's agent, the local power company or other competent engineering consultants.

'On installations where it is not certain that the worker is adequately protected from the rays, a determination should be made with an ultraviolet radiation meter. Through this test the exact exposure to the worker can be evaluated. These determinations will be made without charge by the Detroit Edison Co.' "

Los Angeles Studies Lead And Silica Hazards in Pottery

The Division of Industrial Hygiene, Los Angeles City Department of Health, was asked by a large pottery, employing 1,500 workers, for a survey of lead and silica hazards. Seven days were devoted to this study, during which 52 air samples and 7 material samples were collected. While full details of the findings will be reported at length in Los Angeles, several observations are especially interesting.

An automatic sandblast machine was set up in a location where 15 workers were occupied in other activities. It was immediately apparent that excessive noise created by this machine was lowering employee morale and efficiency in the area. Air samples further showed that excessive free silica dust was being dispersed into the breathing zone of the machine operators, in spite of the exhaust ventilation provided. To comply with our recommendation for adequate control of the dust hazard it was necessary to isolate the sandblast machine or move it completely outside the position in which it was located.

At the opposite end of the same room was an automatic rotary glaze spray machine. The hood enclosing the spray nozzles was provided with seemingly adequate exhaust ventilation. However, an air sample at breathing level showed that dangerous quantities of lead glaze were escaping from the hood. The significance of this finding is in the tendency to judge the effectiveness of exhaust hoods merely by physical measurements of velocity and total capacity. In this case the velocities, by usual standards, were more than adequate. Nevertheless, the position of the spray nozzles and direction of spray apparently rendered the exhaust control inadequate.

Another feature of this spraying operation was noteworthy: Exhausted spray was passed through a separator and the supposedly pure air was recirculated into the workroom through an open stack 15 feet above the floor. Purity of the air was judged entirely by the absence of visible cloud at the stack opening. An air sample taken near this opening showed excessive quantities of lead escaping into the workroom air. It is believed that it will be fairly simple to extend the exhaust duct some 10 feet, through the roof, to prevent recirculation of the subtly hazardous contaminant.

This study emphasizes the importance of close cooperation among the safety, medical, and process engineering departments to prevent health hazards in new installations, and to detect and control hazards in the existing operations. The Division of Industrial Hygiene, Los Angeles City Department of Health is constantly stressing to management the importance of making use of the technical services it provides to aid in controlling industrial health hazards.

DUST CONTROL IN A NEW YORK FOUNDRY

An interesting problem was recently presented by a foundry making very large castings—the problem of providing adequate dust control at a price which was not prohibitive.

The normal castings produced by this foundry are approximately 50 feet long and weigh in the neighborhood of 50 to 60 tons. A study of the foundry, including dust counts, indicated the need for extensive dust-control equipment, and the company was required to install the necessary ventilation.

When the company turned the matter over to several manufacturers of dust-control equipment for competitive bids, however, the bids which were returned ranged in price from a minimum of about $300,000 to a maximum of almost a million dollars. The tremendous burden which this cost would have placed upon the company caused them to reopen a previous appeal to the New York Board of Standards and Appeals.

In an effort to work out a satisfactory dust-control program, at a reasonable cost, two of the engineers in the Division of Industrial Hygiene and Safety Standards spent two full days and nights at the plant watching every detail of the operations, making dust counts and otherwise acquainting themselves with precise dust-control requirements of the plant. Following this comprehensive study, a series of conferences was held with the general manager and safety engineer, and a plan of action was evolved by means of which adequate dust control could be achieved at a cost of approximately $30,000.

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