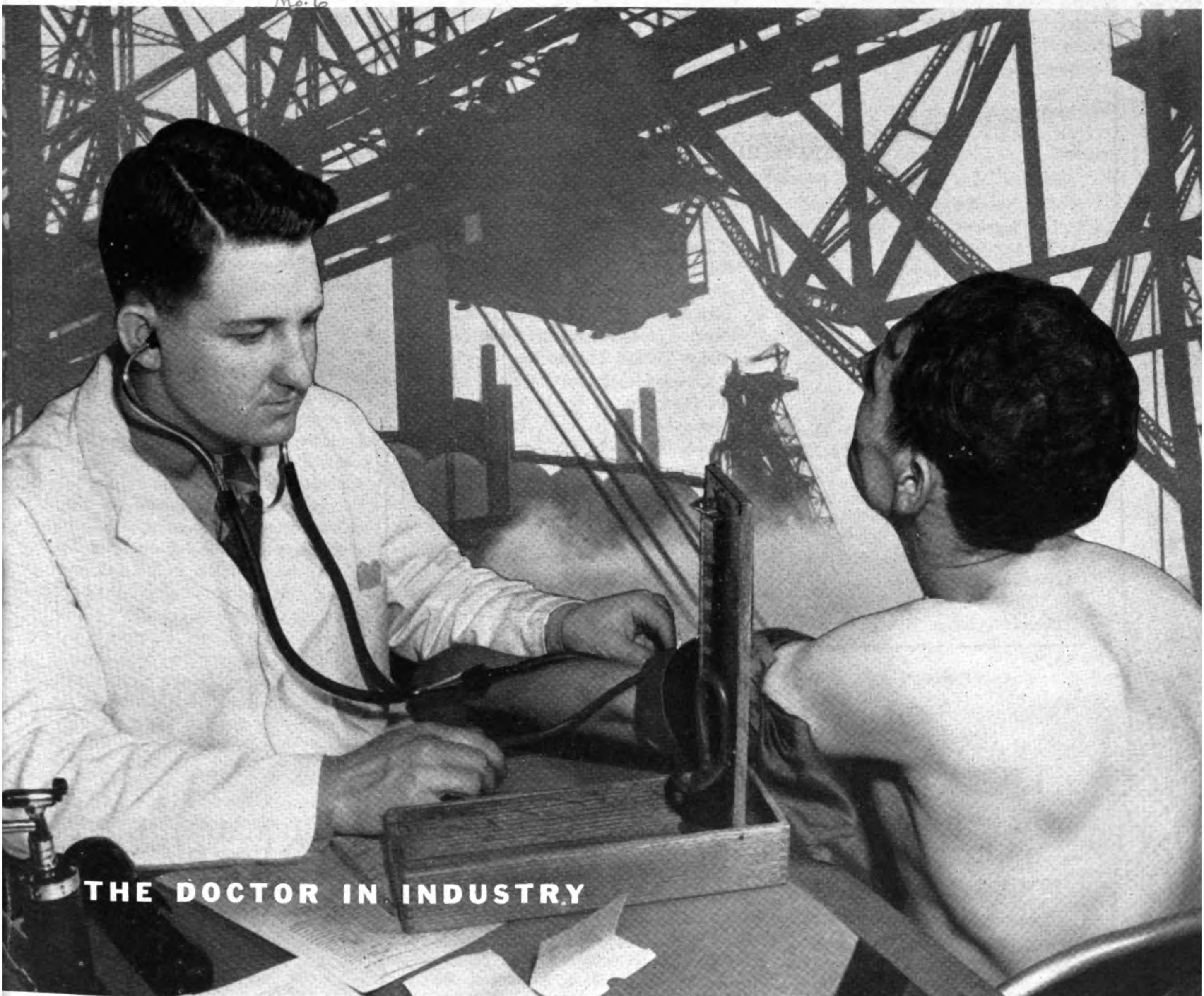
Industrial Hygiene

VOL. 8, NO. 6 JUNE 1948



THE DOCTOR IN INDUSTRY

NEWSLETTER

INDUSTRIAL HYGIENE NEWSLETTER

Volume 8 June 1948 Number 6

Issued monthly by
FEDERAL SECURITY AGENCY
Public Health Service
Industrial Hygiene Division

FEATURES

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Approved March 29, 1946, by Director, Bureau of the Budget, as required by Rule 42 of the Joint Committee on Printing

PROGRAM FOR CONFERENCE IN ENGLAND ANNOUNCED

Six phases of industrial medicine, namely, social aspects, environment, nursing, clinical, practice, and "special," will be discussed at the Ninth International Congress of Industrial Health to meet in London September 13–17, 1948.

Subjects to be presented on the social aspects are work and skill, young persons in industry, incentives, job adjustment, absenteeism, and integration with community health services. The sessions on environment will include a study of the nature of dust, determination of dusts in air, mining, architecture, and the physical, biological, and psychological aspects of environment.

Administration and training will be discussed in the nursing section. Among the subjects planned for the clinical section are pneumoconiosis, mining, newer chemicals, newer metals, dermatology, ophthalmology and burns. The section on practice will devote two sessions to the organization of medical services, two to hazards and other aspects of specific industries, and one to tropical industrial medicine.

Arranged for the "special" section are such topics as industrial medical content of law, application of industrial legislation, training of the industrial medical officer, and radiant energy, its hazards and their prevention.

Persons who desire information concerning the conference should write to the Secretary, Ninth International Congress on Industrial Medicine, Room 501, Garden Court Wing, B. M. A. House, Tavistock Square, London, W. C. 1.

DR. L. A. SCHEELE SUCCEEDS DR. PARRAN

Dr. Leonard A. Scheele was nominated by President Truman to succeed Dr. Thomas Parran as Surgeon General of the U. S. Public Health Service. Dr. Scheele replaced Dr. Parran April 6, 1948, at the close of the latter's third term as Surgeon General.

Dr. Scheele has been with the Public Health Service since 1934 and was most recently Director of the National Cancer Institute.

USE AND ABUSE OF THE PATCH TEST

D. J. Birmingham, Surgeon; P. C. Campbell, Jr., Surgeon; and Louis Schwartz, Medical Director (Retired), USPHS

Substances capable of producing contact dermatitis are unlimited in number. In any given case of contact dermatitis, the offending agent may be obvious or may be extremely difficult to determine.

Because therapy and prognosis are so dependent upon the establishment of a cause in contact eczema, every effort should be made to determine the offending agent. An excellent aid for determining the causes of contact dermatitis was founded by Jadassohn in 1895 when he devised the diagnostic patch test.

The growth of industry and the development of new materials for consumer use have brought greater numbers of new and old chemicals into the list of offenders in contact dermatitis. This growth has contributed to the value of the diagnostic patch and it is now an accepted procedure not only as a means of determining the causative agent in contact dermatitis but also as a means of differentiating between occupational and non-occupational contact dermatitis.

Before any discussion of patch testing can be undertaken, certain fundamentals involved in the procedure must be understood.

The first point of importance is to distinguish between a primary skin irritant and a skin sensitizer. The consultant staff of the dermatology section of the Public Health Service has formulated the following definitions for this classification:

A primary cutaneous irritant is an agent which will cause dermatitis by direct action on the normal skin at the site of contact if it is permitted to act in sufficient intensity or quantity for a sufficient length of time; e. g., strong acids, alkalis, solvents will cause a burn or inflammatory reaction on normal skin.

A cutaneous sensitizer is an agent which does not necessarily cause demonstrable changes on first contact but may effect such specific changes in the skin that, after 5–7 days or more, further contact on the same or other parts of the body will cause dermatitis; e. g., sulfonamide compounds, wearing apparel, cosmetics, photo-developers, and some primary irritants in weak concentration.

The latter group of materials accounts for less dermatitis than do the primary irritants. It has been estimated that about 20 percent of the contact dermatoses of occupational origin are actually due to true sensitization phenomena.

TECHNIQUE

Over a period of years, various modifications and adaptions of the patch test have been developed. Most of the modifications have been alterations in the technique of application and have served to provide information other than diagnostic. The technique consists in applying a small amount of the test material to an area of normal skin of the patient. The test material is then covered with an inert impervious material (cellophane) and this in turn is sealed with a square of adhesive plaster.

Testing with Liquids

A portion of absorbent fabric such as 4-ply gauze or flannel about ¾-inch square is saturated with the suspected liquid, the excess pressed out and then applied to the test area of skin, preferably the back or arms. This is covered with a 1½-inch square of noncoated cellophane. A 3-inch square of adhesive plaster is then used to seal the test material and the cellophane to the skin.

Testing with Solids, Powders, or Crystals

Solids may be soluble or insoluble in water. When insoluble in water, they should be allowed to dissolve in the appropriate solvent and the absorbent fabric soaked in the solution. It should be taken out and allowed to evaporate to dryness. This leaves the absorbent fabric uniformly impregnated with the test substance.

The powder or small crystals may also be placed on the absorbent fabric which has first been moistened so as to make the material more adherent when placed on the skin.

Testing with Ointments

The procedure of testing with liquids can be followed.

Cellophane is used in patch testing because it forms a generally satisfactory line of demarcation between the test reaction and the adhesive tape reaction.

Larger patches of tape (3-inch square) are preferable for use because they are less prone to be lost if several tests are applied. It is advisable not to overlap the tape of one patch with another because it usually causes a more severe reaction to the tape and may disturb the lines of demarcation for future reading of the tests.

Uncovered Patches

Certain substances which adhere to the skin when painted on in solution, may be left on as uncovered patches, for instance nail lacquer.

Twenty-four hours is the usual time allotted for test contact. However, with certain weak concentrations, or low grade sensitizers, it may be necessary to allow test contact for as long as 72 hours. It must always be remembered in such instances that the longer such a test material remains in contact with the skin, the greater the chance becomes of inducing sensitivity.

USES OF THE PATCH TEST

For purposes of simplicity, the uses of the patch test can be generally classified as follows:

A. Diagnostic Patch Testing

Indications—

1. Outbreaks or isolated cases of dermatitis in industry where workers are in contact with sensitizing chemicals.
2. Outbreaks or isolated cases of dermatitis suspected of being caused by wearing apparel, cosmetics, plants, and other environmental contactants.
3. Differentiation between occupational and nonoccupational contact dermatitis.

B. Prophetic Patch Testing

Useful in predetermining the dermatitis-producing qualities of substances or articles such as wearing apparel, cosmetics, or other items which will be widely used in contact with the skin.

In that the test materials are new, it is to be presumed that the subjects to be patch tested had no previous contact with them and therefore are not sensitive before the patches are applied.

Procedure:

Two series of patch tests (10–14 days apart) are performed with the test material on at least 200 subjects. A material previously used satisfactorily for a similar purpose is used as a control patch.

The first series of tests will show definite reactions only if some of the subjects had been previously sensitized to the material or one of its ingredients. If a large percentage of test subjects show definite reactions on the first series of tests, it usually indicates that the substance is a primary skin irritant or it contains a powerful sensitizer which has been in common use.

The second series shows the number of subjects sensitized by the test material.

If, after the 2 series of tests, the number of sensitization reactions caused by the test substance does not exceed the number of reactions caused by the control substance, the test material should be distributed in a small community for trial use.

C. Quantitative Patch Testing

The procedure is designed to determine the sensitizing index of a substance or the degree of sensitivity of an individual to a given substance. Dunn, et al. have perfected a technique both ingenious and accurate which can be used to determine the sensitizing index as well as the individual sensitivity in respect of those chemicals which are soluble in volatile solvents.

It is obvious that the essential factors in the quantitative method of testing depend upon known constants. These are: Known amount of test substance; known concentration of test substance; known area of test site; and known time of test exposure. Each of these constants can be varied as the occasion demands but the basic principles require accurate knowledge in order to derive a quantitative result.

Procedure: To determine sensitizing index of a substance

Patch test a fairly large number of subjects (1,000) using a constant skin area, a constant amount of the test substance in a constant concentration, and let the test substance remain for a constant time. The number of reactors will indicate the sensitizing index of the test substance.

Procedure: To determine an individual's degree of sensitivity

Patch test the subject with several patches using constant skin areas, a constant length of time, and varying the amount or the concentrations of the test substance.

Using a constant area of skin, a constant amount of the test substance, a constant concentration of the test substances on several individuals, for a constant length of time, the degree of reactions obtained indicates the relative sensitivity of the individuals.

INTERPRETATION OF THE PATCH TEST

Patch test reactions are the end result of the action of a substance or substances upon the skin. The interpretation of these reactions requires both experience and sound judgment.

Following removal of the patch test, a sufficient time (15 minutes) should elapse before reading the results. This is done to allow local trauma from the application and removal of the patch to subside.

Various types of reactions have been established and the gradations are routinely followed for uniformity in interpretation. The reactions are commonly designated as 1+, 2+, 3+, and 4+ and are identified as follows:

1+ erythema at the site of contact.
2+ erythema plus edema at the site of contact.
3+ erythema plus edema and beginning vesiculation, and
4+ erythema plus edema plus distinct vesiculation and at times ulceration.

In general, a positive reaction is the result of primary irritation or a sensitization phenomenon. In the case of either, the reaction can be one of 4 types as there are different grades of irritants and sensitizers.

With a sensitizer, the patch test is used as an eliciting reaction, presupposing that the sensitizing contact and incubation period have elapsed. A positive test to the suspected offender indicates that the subject was sensitive at the time of the test. Where a delayed reaction is noted (24, 48, or 72 hours) after removal of the test substance, a lower order of sensitivity is suspected than if an immediate reaction is present.

It can generally be noted that primary irritant reactions tend to subside following the removal of the substance, whereas with an allergic response, the intensity of the reaction tends to increase following test removal. Mild reactions which do not persist for at least 24 hours are probably due to a slight primary irritant quality of the test substance or the mechanical irritation.

In the face of a negative reaction, it can be assumed that the subject was not sensitive to the test substance at the time of the test because (*a*) he may have developed hyposensitivity since contracting the original dermatitis; (*b*) patch test may not have been performed with the actual offending agent; (*c*) the test

An illustration of two positive and one negative patch tests.

substance may not have equalled the offending substance in strength or quantity; and (*d*) adjuvant physical or mechanical factors may be necessary to produce dermatitis.

ABUSES IN PATCH TESTING

The use of the patch test can be of much value, but when used unintelligently the procedure can be so misleading as to become an abuse. There are several pitfalls in patch testing, cardinal of which are listed below:

Patch testing with primary irritants

Don't perform a patch test with a known primary irritant except in known nonirritant concentrations.

Patch testing in the presence of an acute widespread dermatitis

Don't perform a patch test when the dermatitis is widespread and acute. To do so may produce a generalized eruption.

Patch testing in the presence of a systemic reaction

Don't perform a patch test when the patient shows signs of a systemic reaction. Such testing may produce misleading reactions and, moreover, may harm the patient.

Patch testing which produces sensitivity

Don't perform diagnostic patch tests with known sensitizers unless the history indicates previous contact with them. To do so may produce new sensitivities.

Patch testing without controls

Don't perform patch tests with unknown substances without using a control substance or person.

Patch testing in pre-employment examinations

Don't perform pre-employment patch tests. To do so may produce a sensitivity. Only on rare occasion is such a procedure justified.

CONCLUSION

The patch test is by no means a sole criterion for the diagnosis of contact dermatitis. When used intelligently it can serve as a valuable aid in diagnosis and not infrequently it can help to prognosticate the dermatitis-producing qualities of materials designated for mass usage.

Proper performance and interpretation of patch tests require a knowledge of the testing substances. Helpful assistance can be obtained from the published lists of recommended test concentrations by Mayer, Schwartz, and Rostenberg and Sulzberger. Efforts to follow the recommended procedures as outlined will reward both doctor and patient.

REFERENCES

Schwartz, L. and Peck, S. M.: The patch test in contact dermatitis, *Pub. Health Rep., 59:* 546–557 (April 28) 1944.

Dunn, J. E., et al.: A new technique for performing quantitative contact (patch) skin tests. *J. Invest, Dermat., 6:* 323–336 (Dec.) 1945.

Mayer, R. L.: Das Gewerbeekzem. Julius Springer, Berlin, 1931.

Rostenberg, A., Jr., and Sulzberger, M. B.: Substances for patch testing and concentrates to be used, *J. Invest. Dermat., 2:* 93–117 (June) 1939.

Schwartz, L., Tulipan, L., and Peck, S. M.: Occupational Diseases of the Skin.

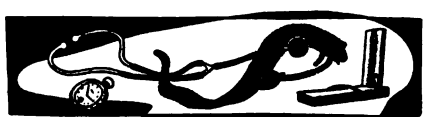
Lea and Febiger, Philadelphia, 1945. Chapter V.

INDUSTRIAL CANCER SUBJECT OF STUDY

The National Advisory Cancer Council of the National Cancer Institute has approved a grant of $32,694 for a study on industrial cancer control, which is planned by the Industrial Cancer Committee of the New York Department of Labor. Dr. May R. Mayers of the Division of of Industrial Hygiene and Safety Standards, New York Department of Labor, is chairman of the committee.

The survey will seek to determine what the potential and actual relationships are between cancer and occupation as a result of exposures, suspected and known, to chemicals and physical agents.

This first large-scope scientific study of industrial cancer control will be conducted at the Roswell Park Memorial Institute, Buffalo, N. Y., under the direction of Dr. Louis C. Kress. Five thousand male cancer patients will be interviewed. Results will be controlled by interviewing 1,000 male, noncancer patients at Roswell Park over a period of 2 years. Men will be used exclusively in the study because of the generally longer continuity of their work histories in an occupation.



RESOLUTIONS

Adopted by the ACGIH at its Annual Meeting, March 30, 1948 at Boston, Mass.

WHEREAS: Industrial hygiene units in various States, cities, and counties are charged with the responsibility of protecting the gainfully employed from exposure to occupational health hazards, and

WHEREAS: The use of radioactive isotopes may result in conditions which adversely affect the health of workers and the general public; therefore

BE IT RESOLVED, That the Atomic Energy Commission be requested to notify State, City and County industrial hygiene units of the identity and location of recipients of radioactive isotopes within their respective jurisdictions in order that the units' responsibilities may be discharged.

WHEREAS: It has come to the attention of members of the American Conference of Governmental Industrial Hygienists in their individual jurisdictions that ozone generating equipment is being offered for sale for the purpose of "purifying" the atmosphere of garages; and

WHEREAS: Scientific research data are not yet available to support claims of the "purifying" influence of ozone in garage atmosphere, therefore,

BE IT RESOLVED: That the American Conference of Governmental Industrial Hygienists is opposed to the installation of ozone generating equipment in garages until well-founded scientific research has been advanced to justify a change or modification of this sentiment.

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Occupational Disease in Differential Diagnosis

H. T. Castberg, M. D.—USPHS

A patient's occupation is frequently a significant clue to his physical condition. A knowledge of his work and work history and the materials to which he is or has been exposed may be all important in the differential diagnosis of an illness.

Occupational History

To obtain information concerning these factors, a careful occupational history must be a part of the present and past medical history. The occupational history must be detailed and include the patient's total work history. Not only is the present work important but information must be obtained of all his previous jobs back to the time he left school or took his first job.

From experience it has been found that it is better to obtain information concerning the present work first. Most persons are able to give data concerning their present occupation in more detail and more accurately than they can for previous occupations.

Next, information is obtained concerning the previous job. Each previous employment is then investigated and recorded in reverse chronological order.

It is more logical to ask a person, "What is your present work, what do you do now?" than to ask him immediately to recall work he did several years ago. He is much more likely to remember details of employment in previous jobs after he has talked about the more recent one.

When an occupational history is being taken, it is useless, many times, to learn merely the name of the job. If a man says he is a molder in a foundry, it has no significance unless the physician is acquainted with the work of a molder and knows what the specific conditions are surrounding that particular job.

In obtaining an occupational history, the purpose is to discover what in the working environment will affect the health of the worker. It is important to learn (1) the number of years or months spent at each occupation; (2) the hazardous materials in the form of dusts, fumes, gases and vapors, with which he works; (3) the concentrations of these materials in the atmosphere; (4) the length of time of exposure to these materials each day; (5) if there is exposure to excessive noise, heat, glare, ultraviolet rays, radium or X-ray; and (6) what control measures are used to reduce or eliminate exposure, and are these protective measures effective.

All of these items are important in evaluating the significance of an occupational exposure. For example, serious illness can be produced by exposure to lead compounds in the manufacture of storage batteries. Work with the dust of lead compounds when uncontrolled by protective measures such as local exhaust ventilation is very hazardous. However, the same job, when proper local exhaust ventilation is provided is perfectly safe. Similarly, even if local exhaust ventilation is provided, the job is not safe unless the ventilation equipment is in proper working order and is doing the job it is designed to do.

Every physician cannot visit the plant where each patient works, but in many instances such visits are extremely valuable. Certainly, if there is some doubt about occupational origin of an illness, such a plant visit is essential. In addition to the plant visit it is sometimes necessary to obtain information on the concentration of a hazardous dust fume, gas, or vapor in the workroom atmosphere. This information can only be obtained by proper industrial hygiene air sampling procedures. In many instances the information may not be available from the plant but the State or local industrial hygiene division may have it. If the work has not actually been done in the particular plant the industrial hygiene division should be able to provide this information after a study of the plant has been completed.

Knowledge of Occupational Diseases is Necessary

According to occupational disease reports received by health departments it is apparent that too often physicians handle occupational diseases in a much too empirical fashion. If the patient indicates that he is working with lead compounds the diagnosis is much too frequently given as lead poisoning without adequate investigation or study.

It is probably understandable why incompetence exists in connection with occupational disease diagnosis. One reason is that very little attention is given to occupational diseases in medical education. Another is the fact that in the past the usual practicing physician only occasionally was confronted with an industrial case of this type and therefore takes little specific interest in it. But now the average physician sees many more cases of occupational origin because of industrialization of almost all sections of the country. Therefore it is important that every physician understand the diseases which can be produced by industrial exposures.

The diagnosis of these diseases is not much different from the diagnosis of other diseases of nonoccupational origin. Each toxic substance used in industry has a specific action on the internal organs or systems and presents specific symptom complexes and signs which are known. To be sure, there are many new materials which are used in industry whose effects are not as yet well known. However, work is constantly being done by research groups to give us that information.

A large heavy exposure to benzol will produce symptoms and signs of neurological origin while long standing "chronic" exposure will cause probably none of the neurological symptoms but will produce definite hematopoietic effects such as anemia and an aplastic blood picture.

Problems in Differential Diagnosis

It is interesting and informative to notice how materials which cause occupational diseases produce symptoms and signs very similar to other diseases of non-occupational origin and must be considered in any differential diagnosis.

Blood.—Stippled cells, for instance, are found in exposures to lead, arsenic, mercury, aniline and nitrobenzene, but are also found in the blood of patients with any disease causing destruction of red blood cells, such as many anemias and leukemias.

The blood may exhibit the picture normally associated with aplastic anemias from excessive "chronic" exposure to benzol. This is an extremely toxic material which is used in many industrial processes. Exposure to radium, X-rays, and gamma rays by action on the system may produce a similar picture.

Polycythemia may be present from exposure over an extended period of time to industrial hazards which cause inadequate oxygen supply, such as carbon monoxide, the cyanides, lowered oxygen tension, as well as cobalt. The nonoccupational diseases which must be differentiated on the basis of this finding alone are polycythemia vera, effects of high altitude, and certain chronic cardiac and pulmonary disease.

Nervous System.—One of the classical signs of lead poisoning is wrist drop or ankle drop. If a patient exhibits this sign the cause must be differentiated from musculospiral nerve paralysis or peroneal nerve paralysis which can be produced by other nonoccupational causes such as trauma or tumor.

Tremor is a common sign which is seen in hyperthyroidism, parkinsonism, and senility. But it is also an extremely important sign when associated with other symptoms and signs in mercurialism and manganese and carbon disulphide poisoning.

Manganese can produce gait disturbances and other neurological signs which may be indistinguishable in themselves from tabes dorsalis or multiple sclerosis.

Severe character changes can be produced by manganese, such as scanning speech or marked irritability, irascibility and extreme nervousness by mercury or carbon disulphide exposure. Even psychoses are produced by such industrial poisons as carbon disulphide. Mercurialism is almost indistinguishable from hyperthyroidism.

Exposures to such solvents as trichlorethylene, carbon tetrachloride and others have a narcotic action similar to alcohol. Cases have been reported in which workmen have been arrested for drunkenness when the worst that has happened was that they had been working over a degreasing tank of trichlorethylene.

Severe encephalitis can be produced by heavy exposure to lead which is indistinguishable from other encephalopathies.

Lungs.—The differential diagnosis of pulmonary disorders causes perhaps most difficulty. Pneumoconioses in various stages or from different causes have varying X-ray appearances. They can be easily confused with such infectious diseases as tuberculosis, mycotic pulmonary infections and pneumonia.

Mitral stenosis exhibits an appearance on chest X-ray similar to early silicosis or asbestosis. Miliary tuberculosis can be confused with nodular silicosis or siderosis. The noduloconglomerate fibrosis of advanced silicosis may be mistaken for malignant tumors.

Liver Damage.—Liver damage is a result of systemic poisoning from such industrial materials as the chlorinated hydrocarbons of these solvents. Carbon tetrachloride is perhaps the most commonly encountered. It is amazing when the toxic properties are so well known that it is used in many industrial plants with no regard to its potential hazard. There are many preparations used industrially which contain carbon tetrachloride mainly to reduce flammability; its presence, however, is not generally made known.

The chlorinated diphenyls and naphthalenes which are used as dielectics also cause liver damage when systemic poisoning occurs from them. In severe cases these will manifest themselves by causing jaundice or high icteric indexes but may be detected by other means when the damage is less severe. In these instances a knowledge of exposure is essential for differential diagnosis from other diseases such as infectious hepatitis or cholelithiasis and thus to prevent errors in diagnosis and treatment.

Kidney Damage.—Kidney damage is a common result of industrial intoxication and must be differentiated from kidney damage from other causes, such as Bright's disease and urinary infections. Poisoning from chlorinated hydrocarbons, many of the metals and many other industrial substances cause the appearance in the urine of albumen, casts, red cells, and other products which indicate kidney damage.

Skin.—The dermatitis of industry is practically synonymous with contact dermatitis. Most of the dermatoses which develop in industry are the result of contact with either primary irritants or sensitizers. The cause of these dermatoses must be determined in order to effect a cure. Since, in most instances, the most important means of curing a contact dermatitis is removal of the patient from the cause, it is obviously extremely important to know whether the dermatitis is caused by some irritant in the patient's working environment or his home.

Acne, for instance, may be merely acne vulgaris which has no industrial cause. But if it is found on the arms or ventral surfaces of the thighs, where oil can come in contact with the skin, the chances are that it is industrial.

The chlorinated diphenyls and naphthalenes produce in persons exposed to them chloracne which may be confused at times with acne vulgaris. This, however, is an entirely different type of skin reaction which requires different treatment.

One of the commonest errors in dermatitis cases is the mistaken identification of industrial contact dermatitis and the subsequent over-treatment which is so frequently given. As was mentioned before, the best cure is removal from the cause followed by bland soothing treatment. Frequently, the dermatitis persists and is made worse by the intensive treatment given.

Mouth and Teeth.—The mouth is frequently a site for early recognition of effect from occupational hazards. Stomatitis and excessive salivation are early signs of mercurial poisoning. If the physician does not learn from the patient's occupational history that there is an exposure to mercury in his work the condition might well be and frequently is treated as an infection or nutritional deficiency.

The metallic line which appears on the gingival margins is commonly an early sign of plumbism, but it may also be an indication of extensive treatment with bismuth compounds. It is important to learn the cause.

Workmen exposed to high concentrations of acids in their working environment develop characteristic tooth erosions and caries. These must be differentiated from caries from other causes.

Eyes and Nose.—Cataracts may result from occupational exposures. Thus, glass blowers after some years' exposure to the red glowing glass have been known to develop cataracts and must be distinguished from other causes of cataract.

Ultraviolet rays cause severe conjunctivitis with marked photophobia and edema. This must be distinguished from other types in order to give proper treatment. This can only be done by investigating the patient's work.

Perforated nasal septum is a common result of exposure to dichromate mists in an occupation such as electroplating, or from exposure to certain arsenic compounds. It is unfortunate to suspect syphilis when a perforated septum is found which is caused by an industrial exposure.

Abdominal Colic.—One of the symptoms which has caused more confusion than many others is the abdominal colic produced by exacerbations of acute lead poisoning. There have been an unfortunately large number of patients who have been subjected to abdominal surgery for appendectomy which was absolutely unnecessary. If the surgeon had inquired into the occupational history and made a few laboratory tests it would have been obvious that the condition was not appendicitis but lead colic.

These examples emphasize again the importance of learning from the patient the work he does and the materials with which he works.

Unless such a comprehensive history is obtained, erroneous diagnostic assumptions will be almost unavoidable.[1]

[1] R. T. Johnstone, *Industrial Medicine and Industrial Hygiene.* Mosby, St. Louis, 1947.

Medical Responsibilities for Industrial Eye Problems

Hedwig S. Kuhn, M. D., Hammond, Ind.

The realization that physical capacities per se must match specific job requirements was in itself not fully recognized until war urgencies tightened up production problems. The idea that there were functional elements (skills) of seeing which could be, and must be broken down into matching patterns of these skills and aptitudes to meet physical job needs, came late but forcefully. Today's and tomorrow's industrial world, research world, and school (learning) world is increasingly dependent on one or more visual functions. Dials, meters, calibrations, precision instrument readings and gauges require varying degrees of high qualities of accuracy, binocular vision, stereopsis and color appreciation at usual and also at unusual work distances.

The medical profession carries a great responsibility to industry to recognize early, correct early and train early even minor irregularities and variances from perfect. It is no longer merely a theory that 20/15 or 20/10 vision rather than 20/30 or 20/20 might be a considerable factor in altering production totals, reject totals and accident rates. It has been proved carefully and completely. Because of the acceptance of this fact, our tasks and responsibilities are clear-cut and definite, and it behooves us to equip ourselves quickly and honestly to meet all problems.

Perhaps the most vivid recent example of our lag in comprehension is the startled professional reaction to the newly launched and commendable Navy Correction-Protection Program. The services asked for in order to bring men up to the visual work standards needed are exacting, or so it seemed to many. Refractions made for specific near work distances, other than usual 14–16 inches distance, demanded new study. A looper working at 8 inches; a man reading dials at 25 inches; an operator of intricate, perhaps dangerous machinery who has to have 20/10 acuity in each eye, not 20/20, must meet these exact and specific requirements.

It is also essential for the profession to be responsible for its optical equipment: exact measurements; frame; eye size; P. D. (distance and near); decentration when needed; and choice of type and height of segment in bifocals. There is no one pattern or one formula. Each job has its own requirements and refracting must again become a fine art and a stricter science. We need to incorporate a thorough knowledge of JOB OPERATIONS so that these "come alive" in our professionally trained minds.

We are pledged to deliver the best of service. We will also learn new ideas fast and learn to accept without resistance, the newer concept of visual job needs, putting all of our energy into doing our job well. To shrug our shoulders now and say, "That's all nonsense, glasses are glasses," may cost us an economic recession or depression, where it hurts most (critical production), or may slow up urgent industrial production at a time of national emergency. All types of industry come to us for advice, correction, and service. The Navy program has merely thrown a spotlight on our seeming unpreparedness.

"Eyes for the job" is no longer a theory or only one way of looking at a problem. It is a full grown fact and a fascinating challenge and responsibility to the professional person.

Georgia Tech To Offer Summer Course in Industrial Hygiene

At the request of many industries and public health agencies throughout the United States, the Georgia School of Technology will again offer in 1948 a summer course in industrial hygiene similar to the one held last summer. Recognizing the many benefits from such a course to the health and safe working conditions of the country's workers, the U. S. Public Health Service is again serving as a co-sponsor and providing facilities, equipment and personnel for the field-training part of the course.

To provide individualized instruction to each student, enrollment will be limited to approximately 20 students. The length of the course will be 12 weeks, June 28 to September 11. Work in course, to be offered on the Georgia Tech campus under the supervision of the Department of Civil Engineering, will consist of five graduate level courses, credit for which may be accepted toward an advanced degree for students with necessary qualifications. Field training, consisting of participation in actual industrial problems under the supervision of the USPHS Communicable Disease Center, will cover all aspects of industry.

A staff of outstanding lecturers and educators will teach courses in industrial sanitary engineering, heating, ventilating and air-conditioning, sanitary analysis, public health administration and organization, and human physiology.

Meeting the Nursing Needs of the Smaller Plant

Eleanor C. Bailey, R. N.[1]

Almost half of all the industrial workers in the United States are employed in plants with 250 employees or less. It is generally agreed that the occupational hazards and the health needs of these workers are as great, if not greater than those employed in large industries. An increasing interest in the employee health needs of the smaller plant during the past decade has been evidenced by numerous experimental programs set up in various parts of the country to provide health services, and to study the results.

These projects have been sponsored by different agencies including medical societies, departments of labor and health, medical practice groups and visiting nurse associations. Since 1941 the Visiting Nurse Service of New York has offered part-time nursing service to plants too small to make it practical to employ a full-time nurse. During the peak of our industrial service we were reaching about 6,000 of the million or more workers employed in small plants in New York City.

Organization

Since it is a practice of visiting nurse agencies to function with representative boards and committees to meet community needs, we followed a similar plan for our industrial nursing service. An industrial advisory committee representing industrial medicine and nursing, department of labor and health compensation insurance companies, a lawyer who has had experience with compensation and medical practice laws, and management and labor have been most helpful and generous with their time in guiding the program, suggesting and approving standards and practices and answering technical questions.

When an inquiry or request for nursing service is received, conferences are planned with top management and the physician who is to direct the medical program to discuss their industrial health needs, their plans for meeting them and the type of nursing service which we as an agency are prepared to provide. Such details as the hours of service, place of the nurse in the health and safety program, types of records to be used, reports desired by management, plans for handling sick absentees and others are outlined.

It is equally important that the doctors and the nurses clarify their working relationships. This includes written emergency procedures to be used by the nurse for first-aid when the doctor is not in the plant. These emergency procedures are for first-aid only. If further nursing care is indicated, it is given only on a specific order for a specific individual. The same nurse-doctor relationship is established in the plant medical department as is recommended and met by the Visiting Nurse Service of New York in the community to secure maximum care and protection for the patient.

Following these conferences a simple contract is signed by the industry and the Visiting Nurse Service of New York and a guide is set up which outlines the fundamentals of the program and the functions and responsibilities of the nurse in the plant. This guide serves as a pattern in developing the program and as a measuring rod to determine what has been accomplished when evaluating the program at a later date.

Qualifications of Nurses

In selecting the staff nurse to work in industry, every effort is made to choose one who is mature, interested in working in industry, knows the agency's policies, and who has had some practice or theory, preferably both, in industrial nursing, as well as public health preparation. If she has not recently worked in the industrial service, she is given an opportunity to observe one or more nurses at work in a plant. Often plans can be made for her to visit a large medical department in an industry of the same type as the one in which she is to work.

During the first few weeks after a nurse is assigned to a new industry, frequent visits are made to the plant by the supervisor in an effort to be readily available when the nurse needs help, and to insure a sound program from the beginning. Later these supervisory visits taper off to about one a month as the nurse becomes oriented and secure in the plant situation. As soon as the regular nurse has her plant program well under way a relief nurse is introduced who can take over in any emergency or when the regular nurse is off duty for vacations, illness, or other absences.

An in-service educational plan for nurses assigned to industry is directed toward assisting the nurse to keep abreast of new trends in the field of industrial health.

Cost of Service

The amount of nursing time required in any given plant is dependent upon the number of employees to be served, the type of industry, and the scope of the health program. Our Industrial Advisory Committee has recommended as a guide a ratio of 9 hours of nursing time to 3 hours of doctor's time per 100 employees per week. This is not absolute and varies with the factors mentioned above. We do not serve any plant on a full-time basis. If and when an industry is ready for a full-time nurse, they are encouraged to take one on their own payroll.

Visiting nurse agencies are in general agreement that nursing service to industry should be self-sustaining but not profit making. Some believe that it may be advisable to have a service operate at less than cost in the beginning in order to demonstrate that a good medical program is worthwhile, but others believe that accurate costs of service give a better picture for long-term planning.

The cost of nursing service to industry through our agency is $2 an hour, and it is based on the actual cost of providing this service. This hourly rate includes our agency's share in payment for nurse's sickness and accident insurance, workmen's compensation, physical examinations and other health services,

(Continued on page 16)

[1] **Industrial Nursing Consultant, Visiting Nurse Service of New York.**

USPHS Studies NaF Exposure At Open Hearth Furnaces

The Industrial Hygiene Division of the United States Public Health Service was requested by representatives of the Republic Steel Corporation and the United Steel Workers of America, CIO, to make a study of the potential health hazards which might be associated with the use of sodium fluoride at open hearth furnaces.

Field work was conducted from January 7 to February 8, 1948, in four Republic Steel Corporation plants in Ohio. Medical and dental examinations were made of 350 males, including 24 Negroes, distributed as follows: 187 in 2 plants now using sodium fluoride, 63 in a plant where sodium fluoride formerly was used and 100 in a plant which had never used sodium fluoride.

The environmental study involved the collection of fume and gases in a combination electrostatic precipitator and standard impinger used in a series. A total of 149 air samples, 16 settled dust samples and 9 control samples, were collected. Laboratory investigations included determinations of the following in the air: fluorine, total fume, oxides of iron, and manganese. X-ray diffractions were made of fume and dust. Urine samples were studied to determine their fluorine content.

The medical study included a detailed occupational history, and a record of past diseases, operations and injuries. Present symptoms were recorded with special emphasis on fume irritative effects. A complete physical examination was performed with attention directed towards any evidence of lens opacity and inflammation of the mucous membranes of the eyes, nose, and throat. Each worker was given a 14- by 17-inch X-ray of the chest, as well as an X-ray of his left wrist and forearm. Urine was examined for albumin and sugar. Red and white blood cell counts, hemoglobin determinations, serologic tests for syphilis, and leucocyte differential counts were made from the blood of each individual.

A clinical oral examination was made of each employee. Procedures used in these examinations consisted of critical inspection of all oral tissues and structures with the aid of two posterior bitewing X-rays and lateral film of the lower left jaw.

Atmospheric concentrations of iron oxide, manganese and total fume were similar in all four plants. The maximum concentrations of iron oxide and manganese were well within safe limits. The weighted exposures to total fume were rather low, although certain jobs involved high exposures of moderate duration. Sodium fluoride concentrations in the two plants using it were similar in magnitude and had overlapping ranges. With respect to both sodium fluoride and total fume, the cranemen had the greatest exposure and the pouring platform men were second. Weighted exposures to sodium fluoride for these last two groups were 2.2 and 0.4 milligrams of sodium flouride per cubic meter of air, and for all others they were negligible. Tar smoke and radiant heat were noted as discomforting factors in need of correction.

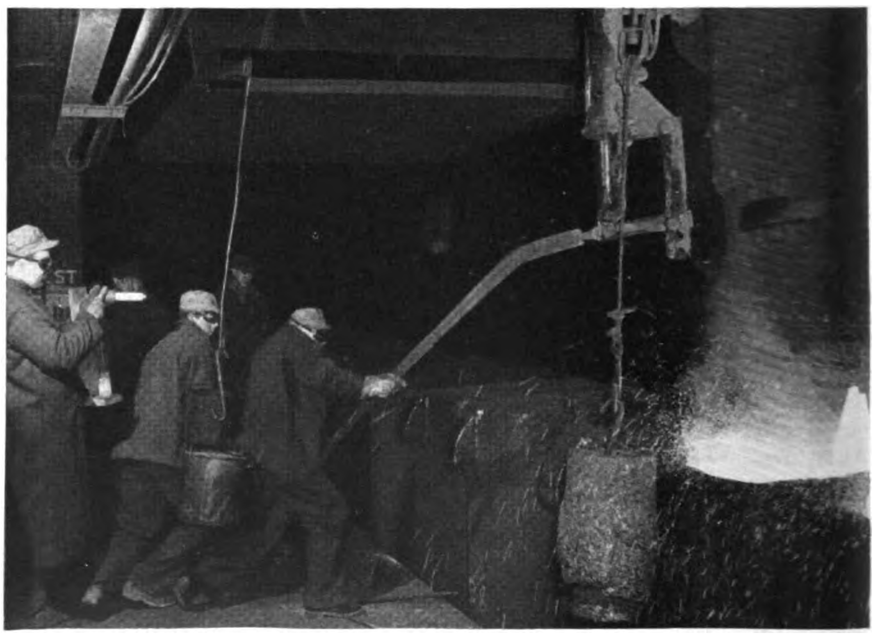
In the light of present information such concentrations of sodium fluoride would not be considered hazardous. However, brief exposures to the higher concentrations of total fume and dusts may irritate sensitive tissues of the nose, mouth, and throat.

No significant physical defects could be directly related to the use of sodium fluoride. Upper respiratory symptoms such as cough were also not related to exposure but, on the contrary, occurred most commonly in the control plant. These symptoms might be attributed to the total fume and dust content of the air in all plants. The laboratory and X-ray examinations did not reveal any condition which might be linked to the use of sodium fluoride. From these findings, it would appear that sodium fluoride does not constitute a health hazard under the conditions of this study.

Conclusions

1. Concentrations of iron oxides and manganese fumes were below the accepted maximum allowable concentrations, and it is concluded that they would not constitute a significant health hazard.

2. When sodium fluoride was added to the molten steel in the molds or ladles, the compound was dispersed, without



Air sampling at a steel pouring operation. A sample is being taken with an electrostatic precipitator and impinger in series by an industrial hygiene engineer from the USPHS. The sodium fluoride in double sealed cellophane bags is thrown into the mold during the pouring of the steel.

chemical change, into the working atmosphere. The weighted exposures of the workmen were not great enough, in the light of present information, to indicate any probable hazard of chronic toxic effects.

3. Acridine and other irritating factors in the smoke from mold coatings, during coating and pouring operations, were very irritating.

4. Discomfort caused by radiant heat was excessive.

5. Fumes, smoke, and dust encountered at the open hearths induce an upper respiratory symptom complex which may be irritating and annoying.

6. According to the data on symptoms by plants, there is an inverse relationship of the symptomatology to the exposure to sodium fluoride.

7. No severe pharyngeal damage results from exposure to sodium fluoride. A slight degree of pharyngitis may possibly be caused by sodium fluoride, tar smoke or sulfur dioxide fumes; it is difficult to separate the effects of these three environmental factors.

8. On a basis of physical and X-ray findings, there were no definite changes attributable to sodium fluoride.

9. Exposure to sodium fluoride has little or no disabling effect on the tissues and structures of the oral cavity. Sodium fluoride does not produce tissue necrosis when introduced into the oral cavity in atmospheric concentrations as experienced in the occupational environments which were investigated. However, sodium fluoride in combination with other fumes and dusts, may be a contributing factor in producing soft tissue inflammation in the mouth.

10. Repeated exposure to irritant factors in the occupational environment may produce increased thickening on vulnerable areas of the oral mucosae.

Recommendations

1. Mold coating operations should be controlled to avoid unnecessarily thick coatings which result in considerable discomfort to workmen while pouring steel.

2. A mold coating material giving less dense and less irritating smoke and fume than the present coatings should be sought.

3. Whenever possible intense exposures to radiant heat should be reduced or eliminated by use of protective clothing, remote controls or other means.

4. The possibility of eliminating dust, fume, smoke, and heat exposures of cranemen by the use of a positive pressure ventilating system with filtering of intake air should be explored.

5. Crane cab windows should be cleaned regularly and frequently to encourage the operators to keep these windows closed during peak exposure periods.

6. If sodium fluoride is bagged by hand, suitable measures should be enforced to minimize or to prevent inhalation, ingestion, and skin contact of the dust.

PHYSICAL EXAMINATIONS FOR WORKERS IN MISSISSIPPI

J. W. Dugger, M. D.[1]

Modern industrial health service is beneficial to the worker, profitable to the employer and a contribution to the general health and welfare of the community. The medical societies as an impartial professional group have a public responsibility to demonstrate the values and benefits of pre-employment and periodic physical examination of all industrial employees in the small plants that do not have this protection. They should also encourage individual employers and their workers to establish a modern industrial hygiene program in their plants.

At the present time we have only two industries in the State of Mississippi with full-time medical service. About 20 percent of the industries have physicians on call or part-time medical service. This leaves 80 percent without medical service of any kind, so the problem was to work out a cooperative plan between local industry and physicians so that medical service would cover all employees in the smaller plants where it is not practicable to employ a full-time physician.

Realizing we needed the help of the State Medical Association, we unfolded the program to them that they might know our plans and to get their approval for the Division of Industrial Hygiene to promote this program between physicians and industry.

The chairman of the Industrial Committee of the State Medical Association consented to present this program to the Council and House of Delegates of the State association which held its meeting in Biloxi, Miss. on May 6, 7 and 8, 1947. The program was accepted and every physician interviewed since that time has agreed to take part in this physical examination program. The following is an outline of the program as presented to the State Medical Association:

(1) The examinations are to be made by the physicians residing in the community of the local plant.

(2) The examination blank is to be uniform.

(3) Examination blanks are to be prepared so that duplicates can easily be made.

(4) The duplicate form is to be mailed to Division of Industrial Hygiene, State Board of Health. Stamped envelopes will be furnished so there will be no expense for mailing.

(5) Examination blanks received in Division of Industrial Hygiene office will be tabulated for statistical information only.

(6) Each physician participating in program will be furnished with examination blanks and referral slips.

(7) The examining physician is to keep on file in his office the original examination form for future reference.

(8) Results of examination of employee are to be confidential between physician and employee.

(9) Physician is to report on referral slip to employer the status of applicant's employability.

(10) Physician's fee of $3 is to be paid by the employer.

(11) Should the applicant require further study of a condition found when he is examined, the expense should be arranged between applicant and physician, and not charged to employer.

(12) Employees on payroll if found with a condition that needs further study should take advice of physician in regard to best method of treating case and method of meeting expense incurred.

(13) In any event that would apply to paragraphs 11 and 12, the $3 fee for original examination is to be paid by employer.

(14) The Division of Industrial Hygiene is to promote this program between industry and physicians.

(15) Chest X-rays and serology tests are to be made by local health depart-

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[1] Director, Division of Industrial Hygiene, Mississippi State Board of Health.

Sound—Its Maximum Allowable Limit And Its Control

George D. Clayton, Engineer, USPHS

Certain health authorities in the field of public health have set standards on sound or noise which range from 80–90 decibels. In setting these standards no reference is made to the frequency. This is a very serious omission. The decibel scale is strictly a physical scale for intensity measurements. However, of primary interest is the sensation which is perceived by the ear as a result of physical stimulus.

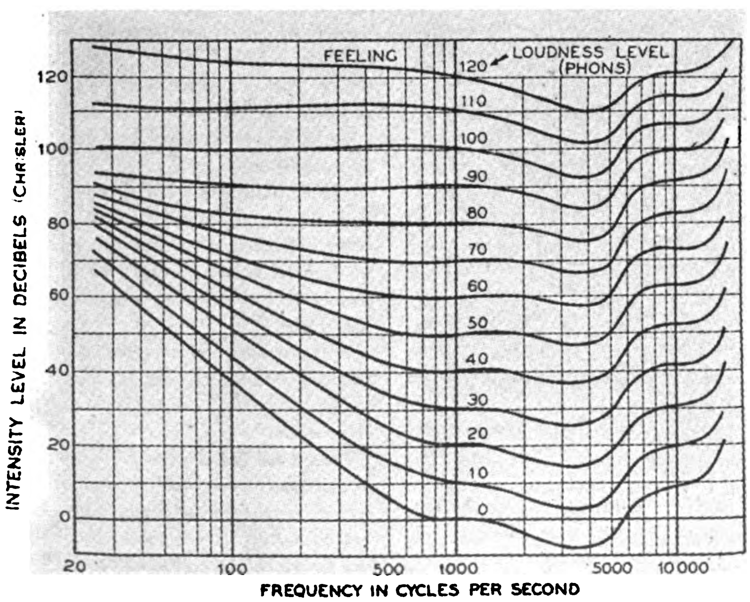
The psychological reaction of the individual varies from person to person so that in order to formulate the relationship existing between physical stimulus and psychological sensation, it is necessary to study a large number of people before any conclusions may be made. It is found in this way that the sensation is a rather complex function of the intensity and frequency. Fletcher and Munson (*1*) performed this experiment and the results are shown in figure 1.

The curves shown in the figure are important. If we select one of the contours such as that numbered 50, then all points on it represent notes which are equally loud; thus a 100 cycle note of 67 decibels intensity level sound is as loud as a thousand cycle note of 50 decibels intensity, or a 7,000 cycle note of about 60 decibel intensity. The lowest curve is the threshold of hearing. It is the intensity level to which the average normal ear can just hear all frequencies from 25–15,000 cycles per second. The uppermost curve is the upper limit to hearing, the so-called "threshold of feeling."

Phenomenologically, it is found that with sounds of this intensity a sound is not only heard but there is also an additional sensation of feeling. The actual sensation varies with frequency. At the lower frequencies a feeling of vibration is experienced, while at the higher frequencies the feeling is one of pain. Thus the area included between the two extreme contours gives the region over which audition is possible.

The intensity level of zero decibel is set to coincide approximately with the threshold of hearing at 1,000 cycles. It will be noticed, however, that the ear is most sensitive at about 3,500 cycles. The numbers on the contours are numerically equal to the intensity level of the 1,000 cycle note at which all notes on this contour are equal in loudness levels. Since a loudness level is not a strictly physical quantity but a measure of a sensation recorded by the ear, it becomes inappropriate to use the decibel as a unit of loudness level. For this usage the term "phon" has been accepted (*2*).

Figure 1.—Equal-loudness contours for the average ear.



There are several other important features about the contours which should be pointed out. From about 500 cycles and up the contours are approximately equally displaced from one another, a 10 decibel increase in intensity corresponding to a 10 phon increase in loudness level. This is not true for the lower frequencies as the curves crowd together at the lower end and a small drop in intensity means a much larger drop in loudness.

Thus, if we have a 100-cycle tone with a level of 100 decibels and we drop the level by 62 decibels, this sound becomes just inaudible, whereas a 62 decibel drop in a 1,000 cycle note would still be plainly audible, having a loudness level of 38 phons. This phenomenon is fortunate in sound-conditioning installations as the commonly used sound absorbing materials will absorb the higher frequency much more efficiently than the lower frequencies.

The importance of the frequency-apparent loudness is illustrated by Wilson and Sabine (*3*):

"Recently the Armour Research Foundation was commissioned to study a calculating machine design for noise reduction. Two calculating machines, A and B, were compared whose sound levels were 70 and 73 decibels respectively. In acoustical energy, machine B emitted just twice the amount of machine A. Forty observers were requested to listen to each of these machines, and each was asked, 'To which machine would you prefer to listen all day?' Of the 40 observers, 29 selected machine B, 9 chose machine A, 2 were undecided.

"Frequency analyses of these two machines showed machine A to have a lower sound level in the frequency ranges of 25 to 75, 75 to 750, and 750 to 2,500 cycles per second, but that machine A had a higher sound level in the range of 2,500 to 7,500 cycles per second.

"The obvious conclusion is that, although machine A had a lower over-all sound level, it was nevertheless considered the more objectionable by 29 out of the 40 observers because of the larger percentage of its sound concentrated in the higher frequency range—2,500 to 7, 500 cycles per second."

SOUND-CONDITIONING

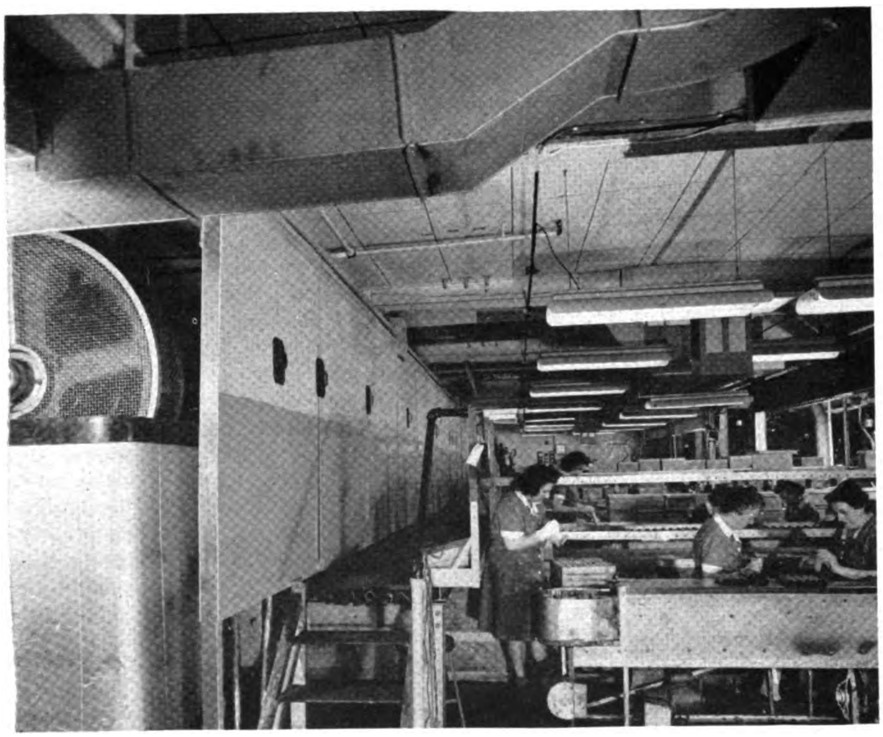
Various methods have been used to control excessive noise in industry. One successful method is substitution. For example, welding has been used to replace riveting which oftentimes produces sound intensities ranging from 95–130 decibels. Unfortunately this method of sound control can be very seldom employed. In the majority of sound control problems the engineer has three methods of attack. Frequently it is necessary to use all three to control the sound adequately. These methods are:

1. Installation of the noise source by resilient mountings which minimize transmission of vibration energy to other structures.
2. Isolation of the noise source by a surrounding enclosure.
3. Acoustical treatment of the room to minimize sound reverberation.

Resilient Mountings

The lack of proper machine mountings and mounting methods accounts for a great deal of unnecessary noises in many factories and shops. It is not uncommon to find heavy machines firmly bolted directly to wood or concrete floors. This practice frequently transforms the floors into huge sounding boards that not only amplify the original noise volume but also help to spread the noise throughout the entire building. Another aspect of improper mounting is mechanical shock. Feeling the vibrations passing along the floor will invariably heighten the sense of loudness and consciousness of the noise.

Resilient mountings will in most cases prove a great aid in reducing noise where such conditions exist. The function of a resilient mounting is to place a discontinuity in the path of the vibrations from the source into the base. These mountings are made in such sizes and styles that the proper amount of suspension may be obtained for practically every type of machine in common use. It should be remembered that noise suppression through the use of mountings is far more than a simple matter of placing a "pad" of some soft material under a machine. Too much or too little resiliency can and will in many cases make a bad situation worse.



This photo shows not only sound-conditioning in a general area, but how movable acoustical baffles have been placed between workers on a packaging line and heavy machinery. Photo by courtesy of Celotex Corp.

Isolation

The isolation of outstandingly noisy machines has been done successfully in various industries. The propeller division of the Curtiss-Wright Corporation, Caldwell, N. J., constructed individual booths for their portable grinding and polishing operations on hull steel blades. The booths were built in a series with one operator assigned to each unit. Mechanical exhaust ventilation was provided for each of the booths. The plant officials reported excellent results with this installation. The noise from a decoring machine in a foundry was contained by placing around it an especially built plywood cage lined with absorbing materials.

The transmission loss of a wall or partition may vary from 25 decibels (poor) to over 50 decibels (excellent), depending upon the materials used and the methods of construction. It also varies with sound frequency and is invariably better at the higher frequencies, which explains why voices in an adjoining room, by losing more of the higher frequency components while coming through the wall, sound like low-pitch mumbles. A good sound-conditioning wall has the ability to resist the mechanical vibration induced by the impinging noise energy either by its molecular parts or by the structure as a whole. This indicates that mass and, therefore, high density are the outward determining physical qualities of a good sound-conditioning wall.

For single walls the highest transmission loss is obtained in mass walls of brick or concrete. Another type of construction which is considerably lighter consists of wood stud construction of two similar but physically supported walls of plaster on building board with air spaces between. Additional information on the subject may be obtained from *Building Materials and Structures*, Report BMS17 by V. L. Chrisler, National Bureau of Standards, Washington, D. C.

Room Treatment

Sound-conditioning materials or acoustical treatment acts upon the ambient sound level by appropriating a percentage of the sound that would otherwise be reflected back into the room. Consequently, in highly reverberant rooms sound-conditioning is especially effective in lowering the general sound level by

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Employee Health and Safety Program Developed in TVA

O. Merton Derryberry, M. D.[1]

The Tennessee Valley Authority is a Federal corporation created by Congress to perform a variety of Federal functions related to the development and wise utilization of the resources of the Tennessee Valley region. Recognizing that the health of employees is of paramount importance to the success of such a project, and aware of the potential impact of its work on health problems of the region, TVA established a Health and Safety Division to administer employee health services and to develop cooperative relationships with public health agencies in dealing with public health problems related to the Authority's program.

For a number of years TVA was engaged in an extensive program of dam construction. From 1933, when the Tennessee Valley Authority was created, to the present time, 16 dams have been built, and at present 2 others are in process of construction. Programs of malaria control, stream sanitation, and environmental sanitation have been established in cooperation with local, State, and Federal health agencies to meet the impact of the TVA program on regional health problems. This article is limited, however, to a description of the health and safety services which directly affect TVA employees.

Approximately 14,200 persons are now employed by TVA. About 7,500 of these are located in three principal areas of employee concentration—Knoxville and Chattanooga, Tenn., and Wilson Dam, Ala. An additional 2,100 or more are located at the Watauga and South Holston construction projects. Some 1,900 of the 3,500 employees at Wilson Dam are employed in activities related to the manufacture of mineral fertilizers, principally phosphatic compounds. The remaining TVA employees are located at widely dispersed points in the Tennessee Valley region in groups varying in size from two or three to several hundred.

Program Coordinated

TVA is among those organizations which have recognized the value of a forward-looking approach to the provision of health services in industry. This organization has included within its Division of Health and Safety an Employee Health Branch in which are brought together in a single administrative unit the responsibilities for planning and appraisal of medical service, industrial hygiene, mental hygiene, and industrial safety. Specialists in these several fields work together as a team in the development and application of effective services. Their efforts are, in turn, integrated with those of other divisions, such as the Personnel Division, to provide a program in which both employees and management understand the increased value which comes from pooling related interests.

Field medical units with a physician in charge have been established in Chattanooga, Knoxville, and Wilson Dam to serve the 7,500 employees in these localities where the administrative centers for the Authority are located. Upon these units the service for smaller groups of employees in the surrounding areas is also based.

Medical Services

Medical services available in these units include preemployment and periodic physical examinations, immunizations, emergency and first-aid care, treatment of occupational injuries, and such minor medical services as may be necessary and feasible for keeping the employee on the job.

Each TVA employee receives a preplacement physical examination which appraises his ability, from the standpoint of health, to work without danger to himself and to his fellow employees. In addition, periodic examinations are provided at intervals of approximately 2 years to help employees remain in good health. Health failures are costly both to the employee and to the employer, and their prevention or early recognition and referral is one of the primary purposes of these periodic health examinations. They may incorporate the use of such diagnostic facilities as X-ray, electrocardiograms, basal metabolism tests, chemical analyses, and other laboratory examinations. A mobile X-ray laboratory equipped for photofluorographic chest studies (70 mm.) is used in making case-finding surveys of all employees.

All employees who have been absent from duty because of illness, provided they have access to a medical unit, are required to secure approval from the medical staff before they return to work. This service is both a protection to the employee and to his associates who may be exposed to danger if he returns to work while his illness is still in a communicable stage. An employee experiencing injury or symptoms of illness while on duty is expected to report to the medical unit at the earliest opportunity for care, advice, or referral.

Mental Hygiene

An industrial mental hygiene program has been inaugurated as a part of the employee health services, since good mental health and physical health are in reality parts of the same thing and together make up the total health picture. Through discussions and conferences with field medical and nurse personnel, a staff psychiatrist has helped them recognize opportunities to incorporate mental hygiene service with other professional service rendered employees. Conferences with supervisors and personnel officers have also played a significant role in the development of understanding and use of the mental hygiene service in cases of emotional maladjustment which come to the at-

[1] Chief Medical Officer, Health and Safety Division, Tennessee Valley Authority, Chattanooga.

tention of these individuals. Counseling of an employee may result from referral by the medical staff of a field medical unit, or may be the result of a request from the individual. In addition, work is advancing toward testing, in cooperation with the Personnel Division, the practicability of including in a supervisory training program some of the principles of mental hygiene as they relate to the supervisory function.

Hospital Service

At the Upper Holston construction projects, as at all previous major TVA construction jobs, a hospital is located near the project area as the medical base for those 2,100 employees. These construction-area hospitals are equipped to provide care for employees who may sustain occupational injury. TVA employees are entitled to the benefits of the United States Employees' Compensation Act of 1916, and through direct relationship with the Federal Security Agency, Bureau of Employees' Compensation, the Health and Safety Division may call in consultant specialists for employees with injuries that require this service. In other instances, these employees may be transferred to United States Marine hospitals should prolonged treatment or convalescence be indicated.

Construction projects are usually remote from medical and hospital facilities sufficient to provide therapeutic medical service for large temporary concentrations of people. Under such circumstances, plans are developed for the medical care of employees and their families who live on the project. They may elect to secure medical and hospital services provided on a prepayment basis by the same staff which meets the construction medical service needs. Nonparticipating employees and their families can obtain the same services but on a fee-for-service basis.

For employees injured on the job near towns and villages remote from the Authority's construction hospitals and permanent medical units, the services of physicians designated by the Bureau of Employees' Compensation are available. When hospitalization is indicated, injured employees are taken by these physicians to hospitals in a nearby community. Preplacement examinations in remote areas are performed by local cooperating examining physicians under a contractual arrangement.

Safety Program

The diversity and sometimes hazardous nature of the Authority's operations require an intensive safety program. This program to prevent accidents extends to all phases of the development of projects, from planning through construction and operations. The safety program as it affects employees is concerned primarily with the prevention of accidents arising out of employment, but an effort is also made to stimulate the development of safe habits and attitudes off the job.

Representatives of the safety section are assigned to construction projects to carry out such procedures as setting up job safety committees and employee inspection groups who hold regular periodic meetings and attempt to stimulate safety consciousness among their fellow workmen. The safety staff also provides advisory services to management in the purchase and use of personal protective equipment, and works closely with field medical offices in deciding whether or not a handicapped person can safely perform a particular job. Because the safety officer knows the working conditions, and the physician knows the health status of the employee, the two together can reach a sound decision as to whether or not the individual can safely perform the particular job.

In addition, a vehicular accident prevention program is conducted among TVA drivers through a monthly bulletin, through administrative channels, and through establishment of a system of drivers' examinations and road tests to assure the competence of vehicular operators.

Sanitary living quarters, wholesome food, and safe drinking water are assured in TVA construction villages by such measures as review and approval of plans for water supplies, for sewage and garbage disposal, and for living quarters; development of plans for water purification and sewage disposal plants in accordance with official State health department standards; and by following all sanitary requirements for food and milk supplies.

Industrial Hygiene

Exposure to various dusts, gases, fumes, mists, vapors, abnormal temperatures, and other adverse environments may be encountered in the variety of activities of TVA. The Industrial Hygiene Section of the Employee Health Branch makes detailed studies of these exposures and conditions, determines the nature of the hazard, evaluates it, and recommends measures for prevention or control. The chemical plant at Wilson Dam, Ala., where mineral fertilizers are made, as well as a number of shops, garages, and hydroelectric plants and the Watauga and South Holston construction projects, are examples of the sources of some of these industrial hazards. Among other controls inaugurated at the chemical plant is a dental health service available to employees potentially exposed to the hazard of phosphorus intoxication. Maintenance of good oral hygiene is a time-honored measure in the prevention of phosphorus poisoning.

Applied research activities on matters such as phosphorus toxicology, methods for dust counting, treatment of chemical burns, and study of ventilating problems are also carried out in the Industrial Hygiene Section.

Educational Program

A special effort is made to maintain and improve employee health and safety by means of education. Opportunities for health and safety instruction occur especially in the entrance and periodic medical examinations, safety interviews, and safety committee meetings. A central health education staff assists field personnel by focusing attention on educational objectives and supplying instructional materials and advisory service on educational techniques. Educational devices in use include motion pictures on health subjects, pamphlets, construction project safety bulletins, organized classes in health subjects, and occasional talks and discussion groups.

Conclusion

The employee health and safety program described in the foregoing paragraphs had its beginning only a few months after the TVA was created by act of Congress in 1933. The ensuing 15 years have seen its growth and development to meet markedly changing needs in support of TVA activities as normal construction and resource development activities gave way to accelerated national defense efforts, and they in turn have been adjusted to postwar conditions. Thus, flexibility has been an outstanding characteristic of the employee health program since its inauguration. The underlying philosophy, the conservation and wise utilization of human resources, has, however, remained unchanged, for while flexibility in method and organization are eminently desirable, there is no justification for compromise of principle.

MISSISSIPPI—

(*Continued from page 11*)

ments or mobile X-ray units of State Board of Health.

The objectives of this program are: To determine employability; to spot neglected medical conditions and recommend corrections; and to provide an industrial health survey in State.

Consultative services of a physician, nurse, chemist and engineer from the Industrial Hygiene Division are now available to industry. With physical examinations made by local physicians, this will give industry a well-rounded industrial health service.

SOUND—

(*Continued from page 13*)

removing some portion of the total volume which is built up through multiple reflections of the original sound. Sound-conditioning with acoustical materials has an even greater effect on its ability to change the character of the over-all sound. Acoustical materials have the ability to appropriate the higher frequencies more readily than the low frequencies. As these higher frequencies usually constitute the more annoying increment of the total intensity the result is often one of marked relief even with a very minor change in sound intensity.

References

(*1*) Loudness, Its Definition, Measurement, and Calculation—Harvey Fletcher and W. A. Munson, Bell Telephone Laboratories.

(*2*) Principles, Practice and Progress of Noise Reduction in Airplanes—Albert London, National Bureau of Standards, January 1940.

(*3*) The Control of Industrial Noise—Allen Wilson and Hale J. Sabine, The Celotex Corporation, Acoustical Department, Chicago, Illinois.

FOUNDATION ANNOUNCES NEW LABORATORY

Industrial Hygiene Foundation has arranged with Elizabeth Steel Magee Hospital, part of the University of Pittsburgh Medical Center, to occupy a laboratory building providing facilities for expansion of the Foundation's basic researches in industrial health. The building is located near the Foundation's headquarters at the Mellon Institute.

Andrew Fletcher, President of the St. Joseph Lead Co. and chairman of the Foundation's Board, in a recent communication to member companies announcing the new facilities, said in part:

"*In addition to our routine plant field studies, we propose to develop at the new laboratory an organization for the primary use of our members along the following lines:*

"*Toxicological studies, including animal work.*

"*Research in industrial hygiene methods along the line of development of new instruments, method of analysis and procedures for use in practical field work.*

"*Engineering research under controlled laboratory conditions, such as air cleaning methods and ventilation requirements.*"

NURSING NEEDS—

(*Continued from page 9*)

relief during sick leaves and vacations, supervision, and some statistical and clerical service, as well as for the time actually spent in the plant by the nurse.

Record Forms

Records are an essential part of the health service and must be complete from the legal and statistical point of view. Since management usually has little idea as to the type of records they need, and in our experience the physicians have preferred not to be bothered with record details, we have formulated and standardized our own record forms. They are simple, inexpensive, mimeographed records which can be placed in a letter-size folder and filed in the standard office files which are available in most industries. These record forms are reviewed frequently and revised as experience indicates needs which may not have been originally anticipated. Records must be confidential and are kept in a locked file in the medical department. Arrangements are made for interpreting medical data by code to other persons interested in the proper placement and welfare of the workers.

Special Problems

One fact that stands out to everyone who has worked in both a full-time and part-time health service in industry is that the fundamentals of a good service are the same in both. The functions of the nurse in industry have been listed in various places by various groups including the industrial physician, the American Association of Industrial Nurses an the National Organization for Public Health Nursing. The phraseology varies but the fundamentals are the same.

However, in the application of these fundamentals, some adjustments are necessary. This is as true in large industries working several shifts and employing a full-time nurse for one shift only as it is for the smaller plant which has nurse coverage for only a few hours on an eight hour shift. In both instances where medical and nursing supervision is lacking for a part of a working day, more attention must be given to the instruction and supervision of those individuals who are to care for emergencies during the absence of the doctor and the nurse.

Likewise, special thought must be given to the scheduling and timing of various aspects of the health program, such as appointments for preplacement and health examinations, interviewing workers returning to work following an absence for illness, and health and safety meetings. An efficient, well-trained industrial nurse organizes these activities and assists with their scheduling and timing, so that the time of the medical and nursing personnel as well as the time of the worker is conserved and used to the greatest possible advantage.

Much work remains to be done if the health needs of the workers of the small industry are to be met. We hope that with the increased interest and demand for optimum health service for these workers that all groups concerned will become more closely allied and combine their efforts toward promotion and expansion of such services, and thereby avoid duplication of effort in these areas.

U. S. GOVERNMENT PRINTING OFFICE: 1948