9. The purposes and acts involved in examination of job applicants and employees varies with the employer involved. For information, see *Guiding Principles of Medical Examinations in Industry*, an AMA publication; also *Occupational Health Services for Employees*, a pamphlet published by the Department of Health, Education and Welfare, which is intended to be a guide for state and local government health programs.

10. 101 N.J. Law R. 496, 130 A. 9 (1925).

11. 362 Pa. 596, 68 A.2d 595 (1949).

12. 235 Mo.App. 594, 144 S.W.2d 850 (1940).

13. 209 S.C. 463, 40 S.E.2d 681 (1946).

14. 108 Cal. App. 591, 291 P. 848 (1930).

15. Section 54 of *Prosser on Torts* points out that a mere gratuitous promise to render service, without more, imposes no tort liability; but three cases, *Marsalis v. LaSalle,* (La. App.) 94 So.2d 120 (1957); *Dudley v. Victor Lynn Lines,* 48 N.J. Super. 457, 138 A.2d 53 (1958); and *Johnson v. Souza,* 71 N.J. Super. 240, 176 A.2d 797 (1961), lay down the rule that reliance by a plaintiff on a defendant's promise gives rise to liability. Hypothetically, if a non-treating physician were to make a promise concerning the discovery of an examinee's disorders, would a cause of action arise from a failure to do so?

16. 273 F.2d 232 (1956).

17. This information was obtained from Dr. Frederic R. Stearns, medical director of Security Benefit Life Insurance Co., until his recent retirement, and present medical director of Inland Life Insurance Co. of America, and Mr. Warren G. Van der Voort of the Van der Voort Associates of Chicago.

18. 134 F. Supp. 554 (1955).

19. 183 Miss. 859, 184 So. 426 (1938).

PLAINTIFF'S EXHIBIT
EXX 62

Nov 1965

METHODS OF SURVEYING TOXIC EXPOSURE IN OCCUPATIONAL ENVIRONMENT*

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In many cases industrial operations may be in a questionable health hazard category, depending, of course, on the level of the occupational exposure. Improved plant control may be costly and naturally management will want proof that it is needed. The tests which can be made to evaluate health hazards in the work place are the subject of this discussion. It is hoped that this discussion will be helpful in those situations where the physician sees the employee-patient before the physician has firsthand knowledge of the industrial environment or plant operations. He may need information on materials handled, atmospheric concentrations, skin contact while patient is on the job, and information on other job-related conditions and exposures.

The Council on Occupational Health has in print a revision[1] of "The Survey of the Occupational Environment" which was first published in 1956. It is one of your guides on good practice of medicine in industry, and its contents serve as a bench mark for the subject matter of this paper. It explains first the importance of getting informed on work areas and second, how to do this. All interested in industrial medicine may profit by reviewing it because it discussed management-physician relationship, plant tours and the purpose of work area surveys and how to recognize potential health hazards. It stresses the importance of explaining the survey findings and interpretations by the physician in terms understood both by the management and employees. In other words, the need for clear communications in this area is fully emphasized.

Where the plant has no industrial hygienist, such services are available through normal channels from the official departments of industrial health or hygiene in many states and in certain city and county health departments. Some casualty insurance companies, various research organizations and university departments of industrial medicine and hygiene as well as many private laboratories and consultants are also available for these professional services.

* Presented at the 24th Annual AMA Congress on Occupational Health, Houston, Texas, 1964.

[1] Now available.

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Results of proper industrial hygiene field and laboratory tests are always helpful and oftentimes necessary to differentiate occupational diseases from others. In many industrial situations, the best action may be to recommend that the plant avail itself of expert professional survey services. A good knowledge on the part of the physician as to why the plant survey is important makes it easier to convince management to accept this cost. Survey tests might include quantitatively measuring atmospheric chemical contaminants, the physical conditions and physical agents or any part of these, along with other measurements where needed to recommend methods of control. Usually the physician may also need blood, urine, or other body fluids analyses, depending on substances handled and workroom conditions. Findings from this type of study or survey serve for the basis of a sound preventive occupational disease program. It is obvious that the physician's experience in the interpretation of the plant survey results and knowledge of control measures being employed permit him to give specific pre-placement and periodic examinations.

Where the raw materials or substances handled by the industrial employee or your patient are received in packages, these containers very often are labeled as to their hazardous nature. Texts of cautionary labels will likely explain the chief health danger and may give pertinent information in acute exposure cases to guide one on first aid measures. From the text on a well-written label, the type of test to have made to evaluate occupational factors in the case will be brought to mind.

To keep this discussion of the method of surveying exposure in occupational environment within a reasonable length, all interpretations and conclusions of analytical data will be limited to reactions of "normal" workers. The yardstick to be applied in evaluating exposures and plant conditions is the Threshold Limits Values reviewed and republished annually by the American Conference of Governmental Industrial Hygienists.

Without further discussion, it is generally recognized that there are differences of opinion on the value of these bench marks or standards and the fact that they are under constant study and are occasionally

changed would justify reservation on their full acceptance. However, in their defense are many years of industrial application with few cases of occupational diseases developing under exposure conditions where these standards have governed. Also, they are practical levels which can be attained by ventilation and operation measures.

The methods to be used in an industrial hygiene survey of a plant will depend on the materials under study. For example, in exposures to mineral dust such as silica, asbestos and talc, the sample is collected in the breathing zone of workmen with a standard impinger. The dust particles are counted by light field technique. This method has been standardized and is recognized by many state workmen's compensation boards. The resulting count is compared to the number set by A.C.G.I.H. The TLV is based on clinical findings in personnel who had prolonged occupational exposure to dust concentrations of known levels and definite chemical composition. We are dependent here on the air sampling equipment and the counting technique for our plant appraisal. There are no usual biochemical laboratory tests to evaluate dust exposure sooner than the appearance of X-ray markings of dust deposit in the chest or the discharge of asbestos bodies in case of asbestos exposure. Pneumonosis-causing mineral dusts are characterized generally by their physical and chemical inertness.

In many cases of industrial exposure to substances, it is both accurate and feasible to use the employee or patient's excretion or body fluids as well as the plant survey results to measure occupational exposure levels. In these situations, the workman may serve as an integrated sampler. Data thus obtained have some advantages over air tests in that they indicate averaged past exposures for days or even weeks; and they reflect body intake by any or all routes of entry: inhalation, skin absorption and swallowing. These substances include benzol or benzene (using sulfate ratio or phenol content), methanol or methyl alcohol and many inorganic elements. Some specific heavy metals are good examples of substances that may be checked by this approach.

The methods of measuring toxic exposure in air for LEAD compounds are well established.

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Urinalysis for lead is specific and blood analysis is specific being directly related to the level of exposure.

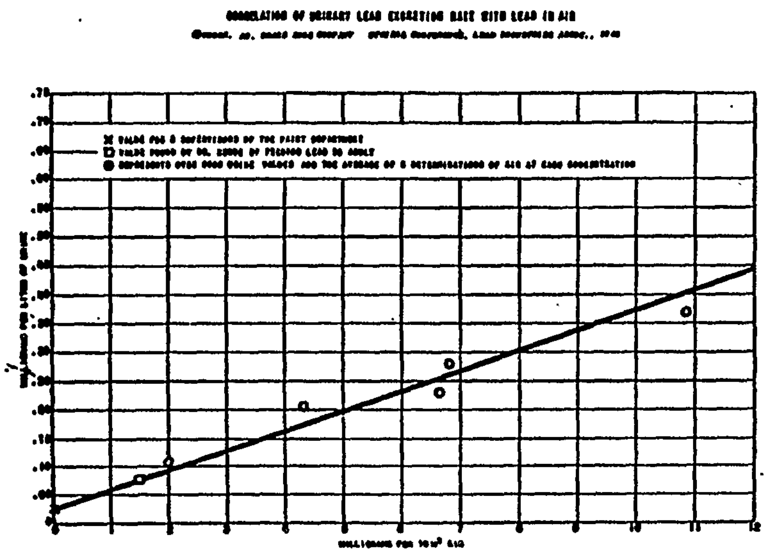

CHART I

Porphyrin is helpful but not specific for lead exposure and also stippled cell count is helpful but not specific. Their advantage is that these tests are quickly and easily made.

Interpretation of urinary values in light of specific gravity is helpful. One milligram per liter of lead is upward limit for excretion from chronic industrial type of exposure. Cadmium excretion limits are lower; whereas mercury, arsenic, fluoride and selenium are excreted in higher concentrations than lead, following severe occupational exposures.

To illustrate the relationship between field conditions and urinary lead values in a major plant paint department over an 8-year period, we have it shown graphically in Chart II. The exposure which was brought into control has since been kept there.

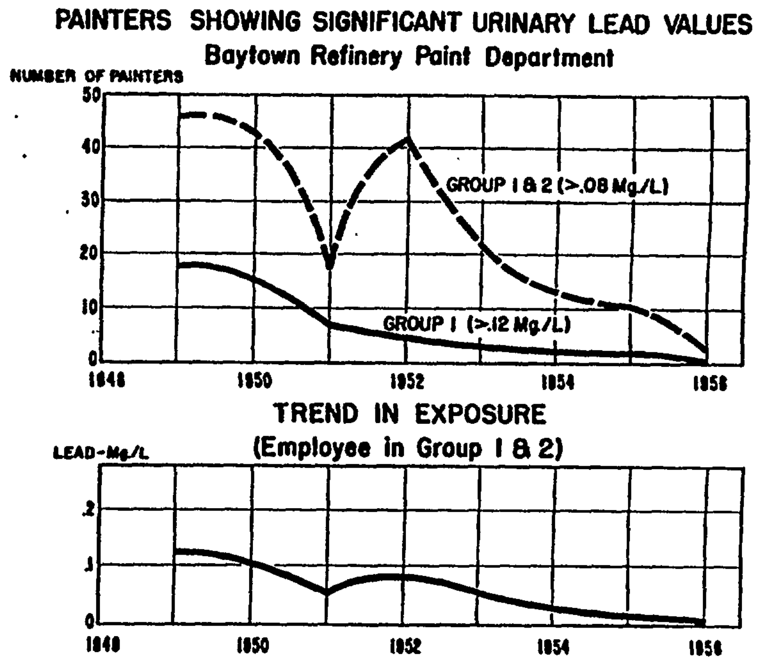

CHART II

Air samples for lead are still necessary and today these may be collected in the workroom and analyzed in the field by modern kits which are readily available. The dithizone colorimetric method is commonly used in these and the laboratory lead tests as well.

MERCURY in most forms or compounds is easily measured by a Mercury Vapor Detector. It measures the air concentration of mercury vapors by ultra violet light absorption. Direct reading colorimetric tubes are available in the last few years. Stable or nonvolatile mercury dust must be measured by the collection on paper filter in an impinger tube or other collector of particulate matters.

Urinalysis for mercury is specific and blood analysis is specific, showing a quantitative relationship to occupational exposure.

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Mercury is more readily excreted by the kidneys than lead; therefore, the ratio of excreted mercury to absorbed mercury is higher than in the case of lead.

Dithizone colorimetric and electroprecipitation are both commonly used laboratory methods for mercury determination.

For CADMIUM evaluation the urinalysis is specific and the dithizone method is generally used. Because the industrial usage of cadmium has been limited, there are not much data to permit correlation of cadmium in the environment to urinary values.

NICKEL – only nickel carbonyl is considered where urinalysis is specific. Also the analysis of hair for nickel deposit or accumulation is specific.

The test is generally made colorimetrically with potassium dithioxalate reagent. It is a sensitive method which is needed for nickel because low amounts are significant.

To evaluate solid ARSENIC compounds the urinalysis for arsenic is specific and the analyses of hair and fingernails are specific. Arsenic may be found in the hair for several months after exposure has ceased.

ARSENIC CONCENTRATION

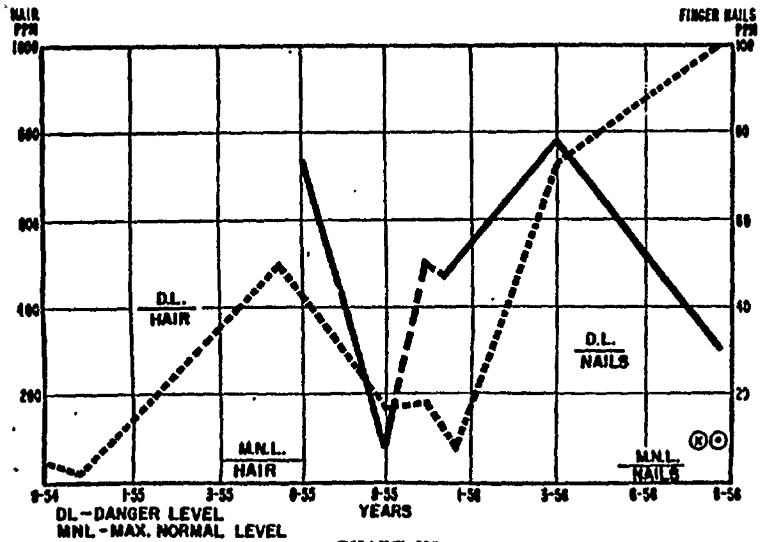

CHART III

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Chart III shows the laboratory results on hair and nails from a patient who was receiving arsenic from some unidentified source over a 3-year period.

The Gutzeit method is both accurate and sensitive for all types of arsenic samples when prepared properly.

ARSINE is a highly toxic gas released from acid reaction on metals containing arsenic in trace to large quantities.

Urinalysis for arsenic is specific for evaluating arsine exposure and also analyses of hair and fingernails are specific for arsenic which readily accumulates where arsine exposure is experienced.

Normal, significant and dangerous ranges: Any detectable arsenic in urine, hair, and fingernails following exposure to arsine signifies danger. Suggested limit is 0.5 mgm. arsenic per liter in urine, > 0.4 mgm. arsenic per liter suggested for Lewisite exposure.

Data on intake and excretion of MANGANESE are not so well established as the metals previously discussed.

Urinalysis for manganese is specific but only positive while exposure is continuing. Blood analysis is specific and shows manganese longer than urine does after exposure ceases.

The colorimetric method with strong oxidizing reagent is generally used.

SELENIUM is a highly toxic metal but seldom found in the industrial environment.

Urinalysis for selenium is specific and the method of choice is the colorimetric one with hydroxylamine reagent.

Occupational exposure to many other substances besides metals can be evaluated by the biochemical technique.

Among the nonmetallic chemicals of importance to industrial medicine are FLUORINE compounds.

Urinalysis for fluoride is specific and the thorium nitrate titration method is accurate in the hands of a good analyst.

CARBON MONOXIDE is released in some level whenever fuel is burned under industrial conditions. It may be measured in the air by available detector kits which give the results on the spot.

Blood analysis for carbon monoxide with hemoglobin is positive and reflects recent occupational exposure. Pyrotannic acid and reagent of sodium hyposulfite, saponine with sodium oxalate may be employed as reagent.

BENZENE or benzol may be checked in the air by detector kit reagents that are readily available. Also urinalysis for inorganic sulfates ratio to total sulfate is specific within four hours after exposure ceases. Specimen should be collected near the end of work period but before the expiration period has passed. This test must be made soon after the specimen is obtained.

The phenol urinary test is also commonly used today and is an accurate method, having the advantage over the sulfate test in that it is possible to keep the sample for a longer period before analyzing it.

Among other common industrial substances which may be measured either by air sampling or by urinalysis are the following list:

Trichloroethylene	Xylidine
Carbon disulfide	Aniline
Dinitro-o-cresol	Toluene
Phenol	Organic Anime
Bromine	Naphthalene
Methyl Alcohol	Organic Insecticides
Vanadium	Beryllium

Physical agents such as noise, radiation, etc., are read or recorded directly by portable instrumentation.

Conclusion

The measurement or evaluation of exposure to chemical and physical agents which are potential health hazards has been discussed briefly. It is necessary to explain that by confining this discussion to the quantitative measurement of exposure levels, there has been no room to describe a full industrial hygiene investigative procedure or plant survey. That would have encompassed a much longer discussion of the detection, measurement, evaluation and engineering control of the environmental agent.

With all due respect to the methods herein described, without which there could not have been established the major number of exposure criteria, it is the correlation of quantitative human exposure data with observed clinical effects in humans which in turn determines the need for engineering control. That is the proving ground of exposure criteria or indeed the proving ground of our environmental hygiene program. The physician in his clinic determines if it is effective and adequate, and the design engineer may work within closer economic limit with assurance.

Instruments or air sampling devices are:

1. Impinger for mineral dust, soluble organic vapors or gases, inorganic oxides, salts, and aerosols or mists.
2. Combustible gas indicator for combustible gases. It is relatively insensitive and nonselective.
3. Gas indicators for H_2S, CO, Hg., etc.
4. Gas detector with reagent tubes for 50 or more common industrial hazardous substances.
5. Test paper methods for direct reading indicators of several gases and vapors.
6. Filtering device for collecting samples that are checked in the laboratory.
7. Electric precipitation for collecting of particles of samples to be tested in the laboratory.

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8. Absorbing devices (bubblers, silica gel, and charcoal) for gases and aerosols samples.

9. Grab sample devices (evacuated flask or vessel) for gases and vapor for laboratory analysis.

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Reprinted from
The Bulletin of the Tulane University Medical Faculty
Vol. 24, No. 4, August, 1965

SCIENTIFIC EXHIBIT

AMERICAN MEDICAL ASSOCIATION, ANNUAL MEETING*
SAN FRANCISCO, JUNE 21-25, 1964

Acute Upper Respiratory Illnesses in Industrial and Military Populations—Epidemiology, Etiology and Prevention

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Industrial workers of a large petrochemical plant and military recruits at a large southern air force base were studied with respect to acute upper respiratory illnesses over the five-year period, 1958-1963. The importance of these illnesses as a cause of industrial absenteeism is demonstrated by monthly frequency rates and days absent from work experienced by the employee group, a stable population of 5,000, average age 45. Similarly, the impact of acute upper respiratory diseases at the military base is shown by monthly attack rates (based on out-patient dispensary visits and hospital admissions) in the recruits, a labile population, average age 20. Etiologic agents of respiratory disease which were active in the populations were identified by virus isolations and serologic responses, and by bacterial cultures for beta hemolytic streptococci. Although a large number of potential etiologic agents were implicated, the findings indicate that a high percentage of illnesses were due to relatively few viruses. There was significant variance in distribution of specific viruses in the two populations. From the etiologic studies, there is reason to believe that multivalent vaccines can be developed to provide protection against a number of respiratory illnesses. Influenza vaccine reduced illness and absenteeism rates during two episodes of Asian influenza in the industrial population, and apparently prevented outbreaks of the disease in the military subjects. Advanced vaccines, which incorporated a common cold virus and additional respiratory disease agents, were demonstrated to significantly reduce illness rates in both populations over a trial period of four years.

* Honorable Mention—Section on Preventive Medicine.

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