FILE NAME: TILO (TIL)

DATE: 1934

DOC#: TIL005

DOCUMENT DESCRIPTION: CT Health Bulletins

Connecticut Health Bulletin

"For a Clean State and a Healthy People"

Vol. 48 **November 1934** **No. 11**

SPECIAL ARTICLES

Stanley H. Osborn, M. D., C. P. H., Commissioner

Issued Monthly by the

State Department of Health
HARTFORD

LABORATORY METHODS IN OCCUPATIONAL DISEASE CONTROL

Allan L. Coleman, B. S., Assistant

Industrial Hygienist

The laboratory is a phase of public health work formed on a foundation of the medical and related sciences to assist in the confirmation of clinical evidence for establishment of a definite diagnosis and in the determination of infection sources. The mere performance of a laboratory test or the accumulation of laboratory data, however, is of little value unless such tests or data are intelligently interpreted in terms of the particular problem or condition. This is true both in general diagnostic laboratory and also in the laboratory devoted entirely to occupational disease control. Just as a negative Widal reaction is insufficient evidence upon which to assert the absence of typhoid fever, so is the absence of a pathological amount of lead in the urine or feces insufficient evidence upon which to assert that lead poisoning does not exist. These findings, however, taken in conjunction with all others in the case may be and often are essential to a clear comprehension of the condition. If in the latter of these two cases a proven history of exposure was found accompanied by symptoms and physical signs of lead poisoning, these would constitute strong presumptive evidence for a positive diagnosis.

The knowledge of actual occurrence of cases provides valuable data for the prevention and control of occupational disease. This alone, however, is but one factor in such a program. While the industrialist may be cognizant of the fact that materials used or evolved in certain processes constitute a potential health hazard, he is not familiar with the action of these materials upon health or the concentrations which present a health hazard.

The prevention of occupational disease today is no longer a matter of mere inspection of environment by a lay inspector. It is usually necessary to determine by means of exact physical and chemical methods whether any particular environment is safe. Actual determinations are made of the number of dust particles present per cubic foot of air or of the concentration of other toxic materials present in the air breathed by the worker. By comparing the concentration of these materials actually found with the minimum amount that will affect health, it is possible to say definitely whether a hazard exists and to what extent.

Samples collected in industrial atmospheres where toxic substances are used or evolved in the process are examined at the laboratory to determine the concentration of the material to which the workers are exposed. Since such determinations usually involve the sampling of large volumes of air, the samples are generally secured by passing a measured volume of the air through a device containing a suitable medium for the quantitative retention of the material in question. The amount of dust, gas or vapor contained in the samples is determined by laboratory methods. A brief description of a number of the representatives methods used in the laboratory for the control of occupational disease may be of interest.

The Measurement of Dust Exposure

It is known that the inhalation of small particles of certain dusts may cause the development of pneumoconiosis, a fibrosis of the lungs due to dust. Certain types of pneumoconiosis, as silicosis, may be complicated with tuberculosis and result in complete disability or even death. Certain amounts of various types of dust can be breathed without producing this condition. For example, continued exposure to less than 9 million particles of granite dust per cubic foot of air can be inhaled without causing fibrosis. Such information on permissible concentrations of injurious materials can be applied to occupational disease control only when methods for determining their atmospheric concentrations are available. For control of dust hazards, it is now a routine laboratory procedure to determine the number of million dust particles per cubic foot of air.

The first thing to be done in making this determination is to collect the dust from a given volume of air. The air to be sampled is drawn through a sampling device—known as an impinger—at the rate of one cubic foot per minute and impinged at a high velocity on a glass plate under water contained in a collection flask. If the air were merely bubbled through the water, much of the dust would pass through and escape; but by this impingement the dust is momentarily arrested, wetted by the water, and thus retained. Samples collected in this manner are taken to the laboratory for examination. Here the dust particles in a measured portion of the sample are counted under the microscope. The technic described by the United States Public Health Service in Public Health Reports, March 1932, after a decade of actual use is followed in the laboratory of this bureau.

In preparation for counting the sample is first passed through a 325 mesh screen which filters out the larger particles since it has been found that dust particles larger than 10 microns (1/2500th of an inch) do not gain access to the lungs. The screening of asbestos dust, however, is omitted since fibres of this mineral much longer than 10 microns have been found in the lungs. A one milliliter portion is transferred to each of two Sedgwick-Rafter cells. The dust is allowed to settle for 20 minutes, after which time the particles are counted under the microscope at a magnification of 100 diameters under light field illumination using an Abbé Condenser. To assure a representative result, five microscopic fields are counted in each of the two cells and the counts averaged, but the average is not taken as the final count until a corresponding control has been subtracted. The number of million particles of dust per cubic foot of air is calculated from the final count. Although dust counts are always important in estimating the extent of the hazard presented, the mineralogical and chemical composition of the dust is also an important factor.

The results of dust determinations are being used today in the control of the serious dust hazards presented by sand blasting operations, rock drilling, foundry operations, stone dressing, asbestos industry, and other processes where dust is produced in the atmosphere.

Determination of Vapor Concentrations in Industrial Atmospheres

It has been necessary to develop in the laboratory various technics for the determination of the vapor content of the atmosphere to which workers are exposed. In the development of such procedures it is desirable that the method itself be simple, that the apparatus be portable so that it can be used in the field and that the analyses can be made in a comparatively short time. The sampling of atmospheres for their vapor content is generally accomplished by (1) using a solid material for the retention of the vapor (2) drawing air through an impinger containing a suitable liquid for the retention of the vapor, or (3) obtaining a sample of the vapor-containing air as such.

The adsorption of organic solvent vapors on activated charcoal may be used to illustrate the retention of vapors by a solid material. In such determinations a measured volume of air is drawn at the rate of one liter a minute through a tube containing activated charcoal which has been previously equilibrated and weighed. The quantity of vapor present in the atmosphere is then determined by the increase in the weight of the tube.

It is exceedingly useful in atmospheres where the vapor in question is the sole or major constituent of the solvent vapor group which may be present. Examples of determinations for which the activated charcoal method is particularly adapted are those of trichlorethylene vapors at degreasing tanks, or carbon tetrachloride vapors at dry cleaning equipment and benzol vapors at rubber cementing operations.

The impinger mentioned above for collection of dust samples is of value in collecting certain vapors. One of its advantages is that it permits the sampling of air at the rate of 35 liters per minute whereas the sampling rate of the fritted glass bubbler, an alternative sampling device, is usually only from 1 to 5 liters per minute. Since the impinger enables one to sample larger volumes of air in a shorter period it is well adapted for field studies, provided laboratory tests show that the vapor in question can be completely retained by means of this device.

This is used for example in determining the concentration of chromic acid mist in the vicinity of chromium plating tanks. Here a measured volume of air is drawn through a dilute solution of sodium hydroxide contained in the impinger. The sample is taken to the laboratory where the absorbed chromic acid is determined by a colorimetric method using s-diphenyl carbazide as an indicator. The concentration of chromic acid is expressed in milligrams per ten cubic meters, which is approximately the volume of air breathed by a worker in eight hours.

Determination of Gases

Atmospheric gas concentrations are determined by (1) absorption of the gas in a liquid contained in a fritted glass bubbler (2) portable instruments operating on a physical or physico-chemical principle, or (3) by collecting a portion of the air for laboratory analysis.

Gas Absorption

The fritted glass bubbler is used extensively for the absorption of gases. Using this method it is often possible to complete the analysis in the field. The determination of hydrogen sulfide concentrations in industrial atmospheres is a useful application of this method. A solution of iodine with starch is placed in the bubbler. As air containing hydrogen sulfide is drawn through, the blue starch-iodine color fades and the exact amount of hydrogen sulfide is determined by titration. Where it is desirable to analyze for extremely low concentrations, a method depending upon the color of an antimony sulfide sol produced by the reaction of antimony tartrate and hydrogen sulfide has been developed at our laboratory.

Physical and Physico-Chemical Methods

Among the methods most readily adaptable to field determinations are those dependent upon physical and physico-chemical phenomena. These include heat of combustion, thermal conductivity, and interference of light. A greater advantage of these instruments is that the results may be read directly from calibrated dials.

The heat of combustion method, for example, has found large applicability in the determination of carbon monoxide in air. A portable instrument has been constructed which gives continuous readings of the carbon monoxide concentrations directly on a dial.

Conclusion

Successful control of most occupational diseases must be based on facts obtained by such laboratory procedures as have been described. Determination of the presence and extent of any hazard that may exist is dependent upon laboratory findings correlated with pathological data and information on occupational environment. Industry is eager to obtain information based on interpretation of such laboratory findings as shown by its numerous requests for this service. The cooperation of all those concerned in occupational disease prevention is essential to the solution of the problem. But only through properly interpreted laboratory findings can complete control of occupational disease be assured.

Connecticut Health Bulletin

"For a Clean State and a Healthy People"

Vol. 48 **December, 1934** **No. 12**

SPECIAL ARTICLES

Stanley H. Osborn, M. D., C. P. H., Commissioner

Issued Monthly by the

State Department of Health

HARTFORD

Occupational Diseases

REPORT FOR THE MONTH OF NOVEMBER, 1934

Dust — Asbestos	
Asbestosis	1
Lead — Metallic	
Systemic Poisoning	1
Poison Ivy	
Dermatitis	4
Spraying — Lacquer	
Lung Irritation	1
Turpentine	
Dermatitis	1
Total	8

APPROVAL OF RESPIRATORS

The United States Bureau of Mines has recently undertaken the testing of filter type respirators for their effectiveness in protecting the wearer against dust, fumes and mists. In view of the differences in the efficiency of various types of respirators, there has been a great need for some qualified organization to pass on those which can be shown to be satisfactory. The Bureau of Mines in their "Schedule 21" has presented a procedure for making tests on respirators which are submitted to that bureau by the manufacturers of the respirators. Depending upon the purpose for which the respirator is designed, it is tested for efficiency in protection against "Mechanically generated dusts resulting principally from disintegration of a solid, such as: The dust clouds produced in the various processes of mining, quarrying and tunneling and the various industrial operations of grinding, crushing, and general processing of minerals;

"Fumes of various metals (usually their chemical compounds, as oxides or carbonates) such as lead, mercury (except mercury vapor), manganese, copper, chromium, iron, cadmium, zinc, magnesium, aluminum, antimony and arsenic resulting from sublimation or the condensation of their vapor, or from the chemical reactions between their vapor and gases;

"Mists as produced by spray-coating with paint and vitreous enamels, chromic acid mist as produced in chromium plating, and other mists of materials whose liquid vehicle does not produce harmful gases or vapors;

"Combinations of the preceding types;

"Combinations to include all of the preceding types.

"In addition to the above types, respirators will be tested for permissibility for protection against a single substance of any of the above types of suspensions."

Not only is the filtering material tested to show that it will not allow injurious amounts of these materials to pass through, but, in addition, the design and construction of the respirator is considered, the resistance to air flow is measured and finally man tests are conducted to show the efficiency of the respirator when worn by men with different facial contours.

This bureau plans to keep on file a complete list of approved respirators. Although it is as yet too early for all of the respirator manufacturers to have their products tested by the Bureau of Mines, it is suggested at the present time that only those respirators be purchased which have been designed for submission to the Bureau of Mines for a test.