

MANUAL OF INDUSTRIAL HYGIENE

AND
MEDICAL SERVICE IN WAR INDUSTRIES

DRS

D., F.A.C.P.

B.S.ENG.

., D.Sc.

., Ph.D.

M.D.

., M.D.

M., D.Sc.

S.

D.D.S., M.P.H.

F.A.C.P.

., S.M.

TH G., A.B.

S, M.D.

E., M.S.P.H.

., Ph.D.

., B.S., R.N.

*Issued under the Auspices of the Committee on
Industrial Medicine of the Division of Med-
ical Sciences of the National Research Council*

PREPARED BY THE DIVISION OF INDUSTRIAL
HYGIENE, NATIONAL INSTITUTE OF HEALTH,
UNITED STATES PUBLIC HEALTH SERVICE

WILLIAM M. GAFAFER, D.Sc.

Editor

W. B. SAUNDERS COMPANY
PHILADELPHIA AND LONDON
1943

of the flat bones of the skull, fractures, and osteogenic sar-

1 to 2 micrograms may produce the amount of radium a worker is 0.1 microgram, as revealed by a change of his occupation and therapy or other mode of therapy is recommended.³⁷ Curtiss³⁸ led air is found to contain more iter, it indicates that at least 0.1 sts in the body.

omatic. The decalcifying therapy nonium chloride, as used by Aub own to increase the excretion of duce the total deposition of radium era³⁹ is possibly of value early in col ned in the trabeculae rather

, thorough medical and dental ex- ed before employment. The com- e of preemployment examination subsequent blood counts. Periodic luding hematologic studies should one month and particular attention ve blood counts. Many authorities air radon test, which is made at year, because a dangerous radium in this way before it has had time blood picture. Leucopenia, relative anemia calls for careful investiga- upation for the worker concerned.

onary Fibrosis, Pneumoconiosis) sis is a broad generic term applied ungs. In a more restricted sense, it duced by inhaled mineral dust. The s of the American Public Health As- "a disease due to breathing air con- terized anatomically by generalized velopment of miliary nodulation in sho-tness of breath, decreased chest

expansion, lessened capacity for work, absence of fever, increased susceptibility to tuberculosis (some or all of which symptoms may be present), and by characteristic X-ray findings."

Classification.—On the basis of the structural changes induced in the lung and the type of dust, the pneumoconioses or pulmonary fibroses may be classified as follows (compare reference 43):

1. *Simple benign pneumoconiosis*, which is virtually a deposition of dust in the pulmonary tissues usually accompanied by pigmentation, and includes, for example, anthracosis induced by coal dust and siderosis induced by iron. It does not incapacitate and roentgenologically shows as a maximum change only an exaggeration of linear pulmonic markings and is of clinical interest only by way of differential diagnosis. Such cases should never be diagnosed as silicosis.
2. *Silicosis*, which is a pathologic pulmonary reaction due to free silica; for example, sandblasters' silicosis. This type of pneumoconiosis results in a classical nodular fibrosis of both lungs, demonstrable both in the X-ray and at post mortem. Massive fibrosis, varying degrees of pigmentation, atelectasis, emphysema, fibrous pleurisy, bronchitis, cavitation, and pneumothorax are among the concomitant pathologic changes.⁴⁴
3. *Mixed forms*, that is, silicosis resulting from the inhalation of mixtures of varying amounts of free silica and more inert pneumoconio-genic dust constituents, for example, anthracosilicosis and siderosilicosis. Most cases of silicosis undoubtedly come under this classification.
4. *Asbestosis*, a characteristic diffuse, interstitial fibrosis of the lungs induced by fibrous minerals which, according to animal experimentation, is due to the mechanical action of the asbestos, producing a ground-glass appearance on the X-ray. It may cause disability and a few fatal cases have been recorded.

Etiology.—Silicosis is incurable and large numbers of work- are potentially exposed to conditions favoring the develop- ment of the disease. The majority of cases of this chronic monary disease occur among workers engaged in mining,⁴⁵ quarrying, ceramics industry, tunnel construction, sandblasting, foundry work.

Inhalation of siliceous dust almost invariably results in sili-

prevailed during the working these silicosis-producing

able size (usually 0.5 to 3

the atmosphere at the breath-concentrations exceeding 5 foot.

number of years.

a free state, such as quartz, on of high concentrations of ces disabling disease in a lation of low concentrations t.

ates, which include the 11 age, either list silicosis in or make certain provisions nia, Connecticut, Delaware, Maryland, Massachusetts, York, North Carolina, North Washington, West Virginia,

on the basis of the 1930 000,000 workers are exposed ns, including X-ray studies,

at from 8 to 25 per cent of y disabling pneumoconiosis; in these dusty trades would e. This resistance of some t than real" if consideration t period required before the lly or even by X-ray study. evelop after at least 7 years ave developed in as short a ther extreme, with exposures more than 30 years may have s to a stage when it can be

ker showing X-ray evidence f simple silicotic involvement oms and physical signs are of the patient has a silicosis, a hracosilicosis), or asbestosis

Symptoms and signs do, however, assist in the determination of disability. Among the symptoms and signs of importance are shortness of breath, particularly upon exercise; cough, usually dry; chest pain, varying from a feeling of tightness in the chest to the sharp, excruciating pain typical of pleurisy; hemoptysis; general complaints such as digestive disturbances, insomnia, and dizziness; decrease in chest expansion; prolonged expiration, especially in association with emphysema; altered breath sounds; rales; and the presence of areas of increased density in the lungs. Infection may complicate the picture at any time and is usually manifested by pleural pain, fever, night sweats, weight loss, aggravation of dyspnea, anorexia, weakness, and a cough producing large amounts of blood-tinged sputum.

Diagnosis.—In establishing a diagnosis of one of the pneumoconioses, all of the following three factors should be considered.*

1. An occupational history which reveals definite prolonged exposure to siliceous dust or asbestos dust.
2. Symptoms and physical signs which furnish valuable information in (a) gauging the extent to which pneumoconiosis has progressed, (b) showing the degree of disability, and (c) excluding other diseases.
3. X-ray findings, which, if classified on the basis of the system recommended by the U. S. Public Health Service, show bilateral ground-glass, nodular, or a more advanced type of lung-field marking.

So long as the chest roentgenograms show predominantly linear pulmonic markings, silicosis or modified silicosis need not be given serious consideration. It is when the shadows in the lung field assume a ground-glass, granular or nodular appearance that they become specific and assume more diagnostic characteristics. Using Irvine and Steuart's analogy,¹⁸ the usual linear pulmonic markings are likened to the branches of a tree and the granular, stippled, or nodular lung-field markings simulate the leaves. Complete foliation then means silicosis. Viewed stereoscopically, the films at this stage will show fine nodulation. Some writers describe a related change in the lung-field appearance as "reticulation."¹⁹ Although not definitely determined, this type of lung-field marking may result from the inhalation of mixed dusts. Later stages will show massive areas of fibrosis, and if infection is present the X-ray shadows tend to be asymmetrical.

Asbestosis is exceptional from the standpoint that the pul-

¹⁸ In the field of forensic medicine it has been frequently demonstrated that autopsy studies will yield essential information.

monary fibrosis is caused by dust containing little if any free silica. The asbestotic patient will usually show clinical symptoms and signs which are out of proportion to the apparently small amount of pulmonary involvement shown by the chest roentgenogram. Large massive shadows are very rarely seen in the chest roentgenogram except in the presence of a complicating infection. On the contrary, the diffuse interstitial fibrosis is manifested by a ground-glass appearance, frequently with fine pinpoint stippling of the middle and lower lung fields. It progresses to terminal diffuse fibrosis usually without nodular predominance in about twenty years.³⁰ A shaggy appearing cardiac silhouette due to involvement of superimposed lung structures and pleuropericarditis is not infrequent. Asbestosis bodies may be demonstrated in the sputum or the lung tissue.

Medical Control Measures.—All applicants for employment in dusty trades should be examined by X-ray. Periodic medical examinations at intervals of one year to possibly three years, including X-ray study of the chest, should be made of all workers in dusty trades in order to detect evidence of active pulmonary tuberculosis and early silicotic changes. The length of the interval between examinations depends mainly on the degree of hazard and the prevalence of endemic tuberculosis.

Clinical study of patients suspected of having pulmonary tuberculosis should be made to determine the dynamic status of such complication. No worker should be rejected on preemployment examination or removed from work, which he is accustomed to perform, merely because of a diagnosis of simple silicosis, but rather the atmospheric dust in which he works should be brought within safe limits. The worker whose first roentgenogram shows healed primary tuberculosis should not be denied employment in a dusty trade on this account alone. If the worker has minimal, arrested, or healed reinfection tuberculosis, he should be allowed to continue his work but should be observed with the same precautions as a man with simple silicosis. Close medical supervision is recommended for all silicotic workers in order to control or prevent serious complications of the common respiratory infections.

Benzene (Benzol) Poisoning

Benzene (benzol) is an excellent solvent for gums, resins, fats, and oils, and as such has found many industrial applications. It is used in the manufacture of rubber, rubber goods,

ETN-233