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X-RAY CORPORATION

MAIN OFFICE AND FACTORY
CHICAGO
2012 JACKSON BOULEVARD

BRANCH OFFICES IN ALL PRINCIPAL CITIES

CABLE ADDRESS
VICTORXRAY CHICAGO

CHICAGO

April 1, 1935

North Carolina Industrial Commission
Raleigh
North Carolina

Attention: Mr. T. A. Wilson, Commissioner

Dear Mr. Wilson:

In response to your recent letter, we are sending you herewith a reprint of a paper by H. J. Holmquest, B. S. (M. E.), on the "Industrial Aspects of the Silicosis Problem," which we hope will be of value to you in your consideration of the installation of x-ray equipment for radiography in silicosis.

There are of course many angles to be considered, and we believe that our representative can be of real service to you. For this reason we are referring your letter to our branch office located near you, the General Electric X-ray Corporation, 114A W. 5th Street, Charlotte, N. C., so that our representative may arrange to get in touch with you and give you full particulars regarding the type of equipment which will meet your individual conditions to the best advantage.

Very truly yours

M J Price

MJPrice/WW

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INDUSTRIAL ASPECTS OF THE SILICOSIS PROBLEM

H. F. Holmquest, B. S.

Chicago, Illinois

GENERAL ELECTRIC X-RAY CORPORATION

DEFINITION AND NOMENCLATURE

The word "pneumonoconiosis" is derived from two Greek words meaning "lung" and "dust". It implies a disease of the lungs characterized by fibroid induration and pigmentation due to the inhalation of excessive quantities of dust. Pneumonoconiosis has been used as a general term, while other terms have been used to identify the type of dust responsible for the disease which varies with the industry or occupation, such as:

Aluminosis, - Aluminum workers:
Anthracosis, - Coal miners;
Asbestosis, - Asbestos workers;
Byssinosis, - Cotton mill workers;
Chalicosis, - Potters;
Ptilosis, - Ostrich feather workers;
Siderosis, - Iron grinders;
Silicosis, - Rock drillers (Grinder's disease);
Tabacosis, - Tobacco workers;

Silicosis is probably the most important form of pneumonoconiosis. The committee on Pneumonoconiosis and the committee on Standards of the American Public Health Association, at a joint meeting in November of 1932, adopted the following definition of silicosis;

> "Silicosis is a disease due to breathing air containing silica ($Si\ O_2$), characterized anatomically by generalized fibrotic changes and the development of miliary nodulation in both lungs, and clinically by shortness 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. The disease is divided arbitrarily into first, second and third stages for convenience of description and possible compensation purposes".

Concerning what happens when dangerous amounts of fine silica dust are breathed in by exposed workers, Sappington (Silicosis - An interpretive Review of Accumulated Experience, published 1932, by Industrial Relations, 844 Rush street, Chicago) writes:

> "In the first place, we are concerned only with dust particles measuring under 10 micromillimeters in diameter, because it is only particles of such microscopic size that can get into the lung tissue proper. Since a micromillimeter is equivalent to one twenty-five thousandth of an inch, it will be seen that dust particles which can cause trouble are microscopic in size and cannot be observed or counted except by microscopic methods.
>
> "The air sacs of the lungs, the smallest structure in the lungs, are also of microscopic size. In the microscopic cross-section of an air sac the air space will be seen in the middle, around which are very thin microscopic walls, in which are the blood and lymph vessels. When particles of dust come into the air space in the middle of the air sac (as shown in cross-section view under a microscope) the so-called devouring cells, which are the phagocytes or white cells of the blood, are attracted and migrate through the walls of the vessels into the air space. These devouring cells then actually surround foreign material or dust particles

and again migrate through the wall of the air sac, through the walls of the blood and lymph vessels and are carried by the blood and lymph streams to various portions of the body.

"When the number of dust particles becomes considerable, the number of devouring cells not only block the lymph glands which are encountered in the course of lymph vessels, but also, in many instances these cells disintegrate, leaving free silica in the glands, which, then undergo fibrosis. This is what makes them visible in x-ray pictures because of the increased density resulting from the formation of fibrous tissue.

"Following this, there is a backing up of the devouring cells and their enclosed dust particles into the lungs proper, and here a fibrous tissue replacement also takes place.

"It is believed that free silica particles, being non-absorbable, are a constant source of irritation, and a serum which is the reaction to irritation is poured out in the lung tissue. This serum changes to fibrous tissue gradually. This is a characteristic reaction which may take place in any part of the body where foreign material is not absorbable and produces an outpouring of serum, which is eventually changed to fibrous strands. Eventually fibrous tissue develops in small, well defined and limited nodules, as they are called, throughout the entire lung tissue.

"Since these nodules are more dense than the lung tissue itself, they sho in the x-ray picture, giving an appearance which is called "'mottling' ".

SYMPTOMATOLOGY

Silicosis is a disease that usually develops very slowly. However, it may velop in two years or even less. Its rate of development is dependent on:

(1) The amount of dust in the inspired air
(2) The amount of silica in the dust
(3) The extent of exposure

Silicosis is insidious in its onset and progress and presents but few sympto or physical signs in its early stages. Patients with early silicosis in uncomplicated form are usually well-nourished and apparently healthy.

Based on a study carried out among 7,722 men employed as miners in the Piche District of Oklahoma, Sayers of the USPHS (Clinical Manifestations of Silicosis, J. A. M. A., Aug. 19,1933) summarizes the subjective symptoms of silicosis thus:

SUBJECTIVE SYMPTOMS OF SILICOSIS

Degree of Silicosis	Dyspnea	Cough	Expectoration	Hemoptysis	Night Sweats	Loss of Strength	Loss Appe
Essentially negative	10.2	13.9	0.9	1.0	0.9	3.5	1.
First Stage Silicosis	18.4	18.2	1.0	2.0	1.3	6.4	3.
Second stage Silicosis	30.8	23.3	3.2	5.5	4.3	11.8	5.
Third Stage Silicosis	43.7	34.4	3.1	0.0	3.1	25.0	6.
Silicosis with Tuberculosis	44.2	42.0	3.7	11.2	6.0	24.0	12.
Uncomplicated Tuberculosis	----	44.2	7.7	17.5	9.6	29.8	14.