FILE NAME: Pennsylvania (PA)

DATE: 1965

DOC#: PA028

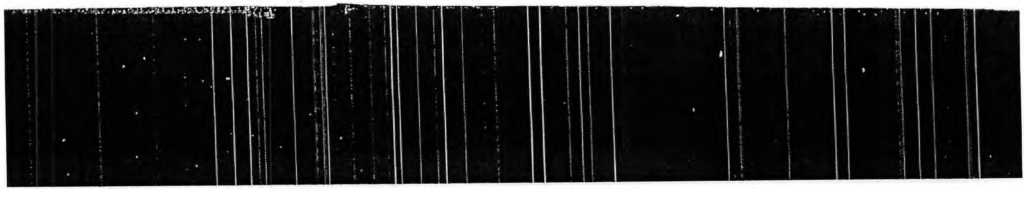
DOCUMENT DESCRIPTION: PA Dept of Health Report - Dust

Pennsylvania Department of
Division of Occupational He.
P. O. Box 90
Harrisburg, Pennsylvania

HIH-19017 P

1966

CONTENTS



DUST

Introduction

Dust is a very important regulating factor in the maintenance and preservation of life on earth. Without its presence as a nucleus upon which filtering moisture condenses, the burning rays of the sun would soon reduce our most densely covered vegetation areas to deserts. It is the dust of plants or pollens which perpetuates the species, and aesthetically, it is the complex mixture of dusts in the atmosphere which produces the brilliant colors of a sunrise or a sunset.

On the other hand, there is a saturation point for everything, and excessive quantities of dust can produce reactions in man from the mildest form of discomfort to the most severe form of disability.

Hazards of Dust

There are several factors which influence the degree of hazard from dusts. These include the composition of the dust, the particle size, the concentration, the length of exposure, and the susceptibility of the individual to a particular dust. If the dust is soluble in body fluids, the result of exposure is an absorptive process which may or may not give rise to systemic poisoning. If the dust is relatively non-soluble, the reaction may be a mechanical plugging of lung spaces or it may give rise to replacement of lung substance by fibrous tissue.

Retention of a given particle in the lung is a function of its size and density. Studies of this characteristic have indicated that the lung does not react to all particles equally. Large particles are removed in the nasal passages and do not enter the alveoli or lung sacs, the smallest recesses of the lung where gaseous exchange takes place. Extremely fine particles, on the other hand, are capable of entering the alveoli, but, because of their small size, are not able to remain there and are forced out with exhalation. Particles of hygenic significance are therefore well defined for silica dust, and research indicates the retention size to be within the range of less than one micron to approximately five microns (1 inch = 25,400 microns).

An exception to the particle size rule is that of asbestos. Particles as large as 100 microns are of physiological importance, probably the result of mechanical irritation of lung tissue rather than a physio-chemical reaction.

The concentration of the dust in air and the length of exposure also determine the degree of hazard. Interpretation of a dust stress upon

exposed individuals follows the general rule of "effect equals concentration times length of exposure". It therefore follows that a response may arise from a short exposure time if the concentration of material is very great, or conversely, the response may arise from continued exposure to smaller quantities of dust. The individual is quite often the limiting factor, however, because it has long been recognized that certain persons exhibit symptoms of exposure even after brief contact with a given substance. Those who demonstrate increased susceptibility should be thoroughly examined before subjecting them to further exposure.

The Engineering Aspect of Dust Control

Air Sampling

In order to evaluate an employee's exposure to dust, air samples must be collected for subsequent analysis. These samples may be collected by several methods among which are impingement, electrostatic precipitation, thermal precipitation, and filtration.

Impingement consists of accelerating the dust-laden air through a narrow orifice toward a collecting plate. As the air velocity increases through the orifice, the particles gather momentum which forces them to continue in a straight path toward the collecting plate. Upon reaching the plate, the air is capable of changing its direction because of its fluidity, but the particles, with their greater kinetic energy, resist the change of direction and are deposited on the plate. The efficiency of collection may be increased by coating the plate or by submerging the orifice and collecting plate under a suitable liquid.

Electrostatic precipitation utilizes an ionizing field of a high electrical potential. As dust-laden air is drawn through this field, the particles are charged and are deposited on a plate. This method is of value when chemical methods or weight determinations are to be made on the dust, but is of questionable value for determining the dust concentration by subsequent microscopic evaluation.

Thermal precipitation is similar to that of electrostatic, but the principle is somewhat different. It was observed that if a hot wire were placed in a dusty atmosphere, the area directly surrounding the wire would become dust free. This principle was incorporated into an apparatus which consists of a hot wire and glass plates. As dusty air is drawn through the apparatus, the dust particles are repelled by the hot wire and are deposited on cool plates, placed near the wire. This method is [illegible] deposits the particles in the same condition as they existed in the air without further shattering during deposition.

Filtration consists of passing dust-laden air through a membrane capable of filtering very small particles. A membrane has been developed which is soluble in several organic solvents. Dust may be collected on the filter and counted directly or by standard methods after the filter has been dissolved. This method is a convenient one also for determining the size of the dust particles collected.

Dust Analysis

Analysis of the dust depends upon the composition of the dust. In the case of soluble dusts, the analysis depends on a straight weight basis, or the dust may be dissolved in a suitable solvent and analysed by chemical or electronic methods. When the dust is regarded as non-soluble physiologically, it is generally analysed microscopically.

In evaluating exposure to dusts which contain free silica, the degree of hazard depends on the percentage of free silica present in the dust. Silica content of settled airborne dust is determined by chemical, petrographic, or X-ray diffraction analysis.

The present standard microscopic method for dust counting is by a light-field method. For liquid collected samples, the solution is diluted to any convenient volume; a portion is placed in a counting cell of one millimeter depth; and the number of particles are counted by means of an optical microscope with a calibrated eyepiece grid. The grid depicts a known area of the counting cell and, by mathematical computation, the number of dust particles present per cubic foot of air is determined. In the case of filtration methods, the membrane is placed directly on a standard microscope slide and is counted using the calibrated disk.

Particle size is determined by means of a calibrated eye-piece micrometer in conjunction with a microscope, and the diameters are recorded in groupings of any suitable dimension. In general, high objective magnification is used so that the size may be measured more accurately.

A microprojection may be used in conjunction with a counter for determining both concentration and particle size.

Threshold Limit Values

As was cited above, the physiological response is the determining

criterion as to whether a dust is harmful or not. In order to establis levels of toxicity, the American Conference of Governmental Industria Hygienists issues a list of threshold limit values. These levels may b defined as the maximum average atmospheric concentration of a contami nant to which workers may be exposed for an eight-hour workday five day per week without impairment to health. These values are obtained fro epidemiological studies of persons exposed, from experimental studies o laboratory animals, or from a combination of the two. The values are re viewed annually and are altered as additional data become available.

Control Measures

Control of dust exposure includes industrial hygiene engineerin principles and good housekeeping. The most fundamental approach to th problem is substitution. This process consists of replacing a materia with one which is less hazardous. An example is the use of steel shot t replace silica sand during abrasive blasting. Another basic control metho is confining the dust at the point of generation. This may be accomplishe by enclosure and separation from the main shop. Dust formation can als be reduced by wetting the material. In the case of falling masses of dust such as hopper loaders, care can be exercised in the design of the con veyor so that the height of drop is minimized. A falling mass entrain air, and when it compresses again, this air is dispelled carrying with i large quantities of dust.

Air movement is the major factor of the dust problem. Particles o hygienic importance move in space only by the movement of air. One mus produce an air-barrier to prevent the airborne dust from reaching th worker. This may be accomplished by local exhaust ventilation at th source and by an adequate collector to reduce the likelihood of an ai pollution problem in the surrounding community.

It should be pointed out that there are many dust producing opera tions which do not lend themselves well to engineering control in tha the expense of installation and maintenance is excessive. These opera tions generally are automatic and isolated. There are times, however when a worker must enter these areas. Since his exposure time is brief he should be supplied with a respirator approved by the U. S. Bureau o Mines for the type of dust to which he is exposed. A respirator, therefore has its place in the control of dust exposure, but it should never be a substitute for adequate ventilation or design control. In addition, a sys tem of good housekeeping should be instituted and periodically maintaine

in order to prevent redispersal of dust from rafters and fixtures.

A system of adequate control of dust reduces machinery wear and its subsequent breakdown. It also creates more pleasing surroundings for employees, thus reducing labor turnover. Most important, it reduces the likelihood of illness among employees, thereby increasing productive capacities for themselves and their employer.

The Medical Aspects of Dust Control

Definition

Dust may be defined as solid particles ranging in size from less than one micron to more than 150 microns. In industry, dusts are produced by reducing solid materials to small sizes by such operations as crushing, grinding, drilling, and blasting. When reduction takes place several differences between the appearance of the parent material and the dust take place. Most important is that the surface area is increased and, on the basis of reducing a one centimeter cube to particles one micron in size, the surface area will be increased 10,000 times. In addition, as the smaller dust particles approach molecular size, they tend to act more as a gas, expanding in volume several times greater than the volume occupied by the original mass. This gas-like behavior thus increases the material's rate of solubility, evaporation, oxidation, absorption, and electrical activity.

Classification

In general, dusts may be classified as animal, vegetable, or mineral. Animal dusts include feathers, hair, leather, and bone. Vegetable dusts are pollens, grain, straw, flour, hemp, paper, wood, tobacco, etc., or other organic dusts such as dyestuffs and intermediates. Mineral or inorganic dusts may be metals such as lead or zinc, or non-metallic dusts such as asbestos, coal, gypsum, quartz, and carborundum.

In the field of industrial hygiene, however, these broad classifications are not practical and, since the scope of this discipline lies in the field of public health, it is better to classify dusts according to the physiological response they create in man. Under this concept, dust may cause an allergic reaction, such as exposure to pollens or most organic type dusts; skin reactions, such as contact of lime or chromates with the skin; systemic poisoning, such as brought about by breathing lead or manganese dusts; or respiratory difficulty either by a simple overloading

of the lung with non-reactive dusts, which reduces the exchange of gas rates, or by a proliferative reaction with the lung itself, such as silicosis.

Types of Dust Disease

It has long been recognized that dust inhalation is capable of producing pneumoconiosis, a lung disease. Pneumoconiosis is defined as lung containing dust. Conditions brought about by excessive exposure to dusts, which do not in themselves cause systemic poisoning, are classed under the general title "pneumoconioses", a broad term which includes most pulmonary manifestations giving rise to illness.

Silicosis and asbestosis are pneumoconioses which cause permanent, irreversible damage and are defined as:

Silicosis - a disease resulting from breathing excessive quantities of dust containing free silica, SiO_2. It is characterized by generalized fibrotic changes and nodulation in both lungs.

Asbestosis - a disease caused by excessive exposure to quantities of asbestos dust and resulting in permanent damage to the lungs by unalterable tissue changes.

Other dusts give rise to lung conditions which may or may not cause disability. In general, these are classified as pneumoconioses but each is usually specifically titled by the name of the offending substance. There are probably as many of these conditions as there are substances, and only a partial list follows:

Anthracosis - a condition caused by inhalation of coal dust and characterized by a deposit of this dust throughout the lungs.

Aluminosis - a dust condition resulting from breathing aluminum dusts.

Beryllosis - a condition resulting from inhalation of beryllium, a rare metal.

Byssinosis - a respiratory disease resulting from inhalation of cotton dust.

Siderosis - a condition resulting from the deposition of iron and iron oxide dusts in the lung.

Talcosis - a dust condition resulting from breathing large quantities of talc.

Vol. 2, no. 1

OCCUPATIONAL HEALTH

News & Views

Division of Occupational Health
Winter 1963-64

Pennsylvania Department of Health
Vol. 2, No. 1

Thanks -

We appreciate the kind words and the many requests to be retained on the mailing list which were received after publication of the first issue of News & Views. We will try hard to continue our newsletter in a manner which will merit your approval. Please remember that we are anxious to receive contributions from readers.

Medical Note -

A plumber developed an indolent ulcer and regional lymphadenitis of an upper extremity. A dermatologist finally made a diagnosis of sporotrichosis and treatment with KI resulted in cure. It was speculated that he must have scratched himself in handling shrubbery while putting in a sewerage system. Within a week another case was reported in a State employee in the Department of Forests & Waters. Studies are under way to determine if the moss which is imported from another state and used in the packing of seedling trees may harbor the infectious agent. A concise description of the disease can be found on pages 172-173 of the 9th edition (1960) of "Control of Communicable Diseases in Man" published by the American Public Health Association.

Hair Sprays -

The possible respiratory and lung hazard to persons engaged in applying hair sprays has prompted the Division to initiate a study of the effects of such sprays on professional beauticians as revealed by 14 x 17 inch chest X-rays. The first step in this study was a two-day chest X-ray survey of beauticians and cosmetologists in the greater Harrisburg area conducted on November 4 and 11. A total of 128 persons participated in this study and further work along this line is anticipated. The X-rays are being interpreted by a radiologist of the University of Pennsylvania. Findings will be reported in a later issue of News & Views.

Publication Available -

A new publication, "Occupational Health Services for Employees", has just been released by the Division of Occupational Health of the U. S. Public Health Service.

The need to conserve health and promote efficiency has increased the interest of both state and local government officials in good safety and health programs. This publication has been prepared to answer requests from government officials on program content, to inform them of what other agencies are doing in the field, and to stimulate greater interest in the health needs of workers. It will, however, be useful to anyone who is interested in occupational health services for an employee group, since the general objectives of all occupational health programs are the same.

Material was secured from publications, and through correspondence and personal interviews. It is limited to data on health services available to em-

ployees at their work place, or nearby, in health units staffed by physicians and nurses. Suggestions in program planning are also included. A number of programs now being operated by state and local government are described in detail.

"Occupational Health Services for Employees" may be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. (20402), at 35¢ per copy. Single copies are available from the Division of Occupational Health, Public Health Service.

Advisory Committee meets -

The first meeting of the Advisory Committee to Establish Short-Term Limits of Exposure to Airborne Contaminants was held in Harrisburg on November 1. The Committee was formed to set standards of permissible concentrations of contaminants in the industrial atmosphere for short periods of time (less than 30 minutes). Twenty-five substances are currently under study.

The Committee members are: Prof. Theodore F. Hatch, Graduate School of Public Health, University of Pittsburgh; Mr. Newton E. Whitman, Bethlehem Steel Company, Bethlehem; Dr. Henry F. Smyth, Jr., Mellon Institute, Pittsburgh; Mr. William M. Pallies, Electric Storage Battery Company, Philadelphia; Dr. Edward V. Henson, The Beryllium Corporation, Reading; and Dr. Heinrich Brieger, Division of Industrial Medicine, Jefferson Medical College, Philadelphia.

Technical Notes -

An intensive study was made recently to reduce employees' exposure to solvent vapors while spraying large athletic mats. Vinyl plastic mats are made by joining small sections with a suitable solvent. The mat is then sprayed with a pigment using a mixture of toluol and methyl isobutyl ketone. Exposure levels were in excess of 2000 parts of vapor per million parts of air, and two employees were overcome by the vapors. Ventilation rates were inadequate to control the vapor concentrations, and additional ventilation was impractical because of the size of the mats (up to 45 feet in diameter) and the problems associated with heating the make-up air supply. The situation will be corrected through the use of supplied air respirators with compressed air coming through plumbing which is equipped with suitable tap-in joints to permit mobility of the workmen.

Industrial hygienists of the Pennsylvania Department of Health recently participated in an investigation of a reported "radium robbery". Radium capsules, containing a total of 110 milligrams of radium, were initially reported as stolen from a hospital. Further investigation revealed that the capsules were unknowingly and accidently dropped from a carrier while enroute to storage, and that a hospital employee took them home believing they would be suitable for fishing sinkers. All capsules and radium were eventually recovered and returned to the hospital.

During a discussion of grain-fumigation techniques, a flour mill owner related that his method of grain aeration greatly reduces the need for fumigation and, thus, the public consumption of residual pesticides (and pests) is reduced. He stated that, since insects, bacteria, fungi, etc., reproduce and are more active in the spontaneously generated heat and humidity of long-standing grain, continually moving the grain with a bucket conveyor through air currents provided by a mechanical fan keeps pests at a minimum. Fumigants are never applied directly to the grain, as is done at most establishments, but are applied only to empty bins.

An extensive survey was begun at a Pennsylvania plant which manufactures asbestos products. Samples were taken with midget impingers (using 95% ethyl

alcohol) and membrane filters. These were counted by phase and light-field techniques in order to compare sampling methods. The data obtained will be used by the Public Health Service as a part of their comprehensive study of the asbestos industry.

Three industrial hygienists of the Pennsylvania Department of Health entered graduate schools of public health this year. Ronald Richards is attending the University of Pittsburgh, Pantelis Rentos the University of Michigan, and Edward Ebersole the University of North Carolina.

Microwaves -

We include as a supplement to this issue of News & Views a copy of our recently prepared Hygienic Information Guide on the subject of Microwaves. This is a timely topic for industrial hygienists and other occupational health personnel.

Personnel Notes -

Robert Diakun, an industrial hygienist with the Department of Health since 1956, has resigned to accept a similar position with Humble Oil and Refining Company, Bayonne, New Jersey. Bob has a Master of Science degree from the University of Pittsburgh Graduate School of Public Health.

Paul Gronka has been appointed to the position of regional industrial hygienist at the Department's Region II office in Williamsport. Paul has been an industrial hygienist in the Wilkes-Barre office since 1960.

Occupational Health Nursing -

The Delaware Valley Association of Industrial Nurses and the Engineers Club of Delaware County met together on December 16 for a Christmas party at the Towne House in Media. The next meeting of the Association will be on January 20. It will be a dinner meeting at the Rose Tree Inn in Media which is scheduled for six-thirty. Any of you who would like to attend this meeting or become members of the Association are asked to contact Miss Edna Butterworth, R.N., Scott Paper Company, Chester. The telephone number is Fremont 4-4331, Extension 256.

The Mason-Dixon Association of Industrial Nurses were guests of the Pennsylvania Sand & Gravel Company, Hancock, West Virginia, on November 23 for a tour of the plant. Mrs. Betty Bealman, R.N., served as hostess. The group had luncheon at the Park View Inn in Berkeley Springs, West Virginia. The March meeting of the Association is to be held in Harrisburg at the Nationwide Inn on March 21. This will be a luncheon meeting and an interesting program on Narcotics has been planned. If you would like to attend this meeting or join the Association, please get in touch with Miss Marilyn Ahern, R.N., Marathon, Inc., Chambersburg.

At the recent convention of the Pennsylvania Nurses Association, Mrs. Kathryn H. Alles, R.N., Selas Corporation of America, Dresher, was elected chairman of the Occupational Health Section.

The Milco Undergarment Company in Bloomsburg is now providing an occupational health nursing service for its employees. We welcome Mrs. Rita Seybert, R.N., and congratulate Milco!

Did you read the article on mononeuropathies in the November 1963 issue of the Journal of Occupational Medicine or "The Treatment of Burns with Ice Water,

Phisohex and Partial Hypothermia" in Industrial Medicine and Surgery for September 1963?

Miss Mary G. Deegan, R.N., of this Division, is still convalescing from orthopedic surgery. Our best wishes and prayers for a full recovery go to Mary.

The Berks County Association of Industrial Nurses held their annual Christmas dinner party on December 13 at Nick's Riveredge Inn. If any of you would like to join the Association, please contact Mrs. Anne Gehrke, R.N., Birdsboro Corporation, Birdsboro. Membership is not limited to those working in Berks County.

The annual educational conference of the Philadelphia Association of Industrial Nurses will be held on Saturday, April 4, 1964, at the Bellevue Stratford Hotel. The topic for the conference is "P.A.I.N. Presents 'Pain' ".

The business and educational conference of the Pennsylvania Association of Industrial Nurses is scheduled for May 9, 1964 at the Berkshire Hotel, Reading. A business meeting including election of officers will be held at the morning session. The afternoon will be a program meeting with workmen's compensation as the subject. Further information may be obtained by writing to Mrs. Betty Weagley, R.N., Letterkenny Ordnance Depot, Chambersburg.

An effort was made to contact one person in key areas to serve as reporter for that particular area. However, we want every one of you to feel free to contribute to Occupational Health Nursing's Section in News & Views. So, please send us personal items, news about a pertinent book or article, scheduled meetings - not only those of industrial nursing groups, but of related organizations and any other information or news you feel would be of interest.

The coupon below is repeated for your convenience. If you have already requested that your name be placed on our mailing list - please disregard.

Please continue to send me Occupational Health News & Views.

Name_____

Address_____

City _____ State_____

Company or other Affiliation_____