FILE NAME: TILO (TIL)

DATE: 1934

DOC#: TIL004

DOCUMENT DESCRIPTION: CT State Dept of Health Report

State of Connecticut
PUBLIC DOCUMENT NO. 25

FORTY-NINTH REPORT

(57th Year)

OF THE

STATE DEPARTMENT OF HEALTH

For the Year Ended June 30, 1934

STANLEY H. OSBORN, M.D., C.P.H., Commissioner

HARTFORD, CONNECTICUT
1934

BUREAU OF OCCUPATIONAL DISEASES

To Stanley H. Osborn, M.D., C.P.H., State Commissioner of Health, Hartford, Connecticut:

SIR:—I have the honor to submit the report of the Bureau of Occupational Diseases for the fiscal year ending June 30, 1934.

PERSONNEL

The personnel has not changed during the past year:

Albert S. Gray, M.D., Director
Warren A. Cook, A.B., Chief Industrial Hygienist
Allan L. Coleman, B.S., Assistant Industrial Hygienist
Hilda Baltzer, Secretary

INTRODUCTION

With the constant accumulation of evidence on the injurious effects of unhealthful working environment and the steadily increasing costs of compensation for occupational disease, it is realized that the only answer to the occupational disease problem is prevention. Connecticut, itself, with so large a portion of its population engaged in manufacturing and mechanical industries had the foresight to recognize this fact and for the past several years the bureau has been conducting studies and surveys of working environment for the purpose of preventing occupational diseases. It is interesting to note that recent reports from various sources have shown that this appreciation of the importance of prevention is being recognized not only by health authorities but by many varied groups concerned with this problem, and there is a growing tendency toward enlarging the scope of activities associated with this subject.

So important and definitely recognized is this effect of industrial environment on health that health authorities have accepted the responsibility for occupational disease control as a public health problem of the first magnitude. Haven Emerson in his presidential address at the Annual Meeting of the American Public Health Association said:

"Let us incorporate within the permanent functions of health departments, protection of employed persons against health handicaps inherent in the place and nature of their work."

At that meeting a resolution was passed by the membership of the American Public Health Association as follows:

"WHEREAS it is the responsibility of the health authorities to protect the population from all preventable diseases, and

WHEREAS unhealthful occupational environment constitutes an important and wide spread cause of increased morbidity and mortality among the large group of wage earners and among the general population, and

WHEREAS control of health hazards in occupational environment is vital to the prevention of occupational diseases, therefore

BE IT RESOLVED, That it is a function of the department of health to include as an integral part of a complete public health program the protection of the

population against health hazards resulting from unhealthful working environment, and

BE IT FURTHER RESOLVED, That the American Public Health Association recommends to each State Health Department of an industrial state the establishment of a Bureau or Division of Occupational Diseases or Industrial Hygiene under the supervision of a physician trained in Public Health and Industrial Hygiene, with adequate technical and laboratory facilities and personnel, empowered to make investigations of working environment, for the control of industrial health hazards and the prevention of occupational diseases."

At the June meeting of the State and Provincial Health Authorities of North America a similar resolution was passed.

During the past year National and State Trade Associations, Insurance Interests and Departments of Health in industrial states have displayed great interest in the method used in Connecticut for the administration of occupational disease control.

Industry is penalized through compensation payments if its environment causes occupational diseases and, if it can be definitely shown that a health hazard exists, realizes that it is a matter of good business to control the condition causing it. With a set-up such as we have in Connecticut, where the law provides that the results of investigations cannot be used in compensation claims, with a specially trained technical personnel to make determinations and interpret the conditions found in industrial environment, industry is provided with just that information it has a right to demand before it is required to change its processes, substitute materials or take other measures of control.

It is our experience that when industry is approached by a health agency in behalf of a health program and is presented with definite data regarding its working environment, in a spirit of service with the assurance that the results of investigation will not be used in furtherance of claims against it, industry not only accepts the service but actually requests the assistance of such an organization in the improvement of its general working conditions.

OUTLINE OF WORK DONE

A total of 355 field trips were made, of which 155 were to manufacturing plants. Surveys of plant conditions totaled 148. Thirty-two technical studies of specific hazard were conducted. These involved 446 field determinations, including collection of air samples for analysis, and 914 laboratory determinations. A number of these laboratory determinations were in connection with development of methods necessary for conducting our field studies.

The consultation service has grown to such an extent that it was believed desirable to keep a record of this phase of our activities. A total of 264 requests for information or advice of the bureau were taken care of from January to June 1934. Of these 110 were consultations at this office, 71 handled by telephone and 83 by letter. The subjects covered in consultation service, which are listed below, do not include the many items discussed in connection with our field trips but are limited entirely to matters taken up from our office.

SUBJECTS COVERED IN CONSULTATION SERVICE

(Includes January-June 1934 only)

Dust Hazards and Related Problems

Asbestosis, general	4	
Pneumoconiosis, general	4	
Silicosis, general	8	
Dust Determination (Field and Laboratory Methods)		
Methods of dust counting	6	
Quartz Determination	3	
Dust Hazards, Misc.		
Aluminum oxide grinding wheels	1	
Calcimine	1	
Coal dust	1	
Fluorspar	1	
Mica and Feldspar Mining	1	
Pathology	3	
Slate dust	1	
Dust Problem in Specific Industries		
Brick Manufacturing	1	
Cotton Industry	2	
Foundries	13	
Parting Compounds	4	
Sandblasting	2	
Tuberculosis	1	
Granite Quarrying	2	
Polishing Compound Manufacturing	2	
Rock Drilling	12	
Rubber Goods Manufacturing—Soapstone Dust	1	
Tobacco Industry	1	
Trap Rock Crushing and Screening	2	
Organic Dust		
Castor Pomace	1	
General Dust Conditions		
Control Measures	8	
Respirators	3	
Sericite	5	
		96

Toxic Substances

Arsenic	3	
Chromic acid	1	
Lead and Compounds		
Brass Casting	6	
Diagnosis and Treatment	1	
General	1	
Method of Determination in Air	2	
Motor Cleaning	6	
Paint	1	
Tetraethyl Lead Regulations	1	
Type Casting	1	
Mercury	2	
Determination Method	1	
Metex	1	
Naphthalene	1	
Sodium Fluoride	1	
		29

Gases

Ammonia	1
Carbon Monoxide, general	9
Chronic Effects on Brain, etc.	4
Exhaust Gas from Gasoline Engines	12
Welding within Enclosed Areas	2
Formaldehyde	3
Hydrogen Sulphide	4
Phosgene	1
Refrigerants	3

Organic Solvent Vapors

Aniline Oil-Textile Dyeing	1
Benzol	5
Determination Method	2
Carbon Tetrachloride	7
Chloracetophenone (Treatment of)	1
Ethylene Dichloride	5
Halogenated Hydrocarbons	2
Phenol	3
Solvents, general	1
Determination of—Typewriter Cleaning	1
Volatility of	1
Spray Painting	1
Trichlorethylene	3
Varnish Remover (Benzol and Methanol)	1

Occupational Diseases General

Activities of Connecticut Bureau of Occupational Diseases	6
Dermatitis	
Cutting Oil and Compounds	3
Prevention	11
Woods	2
Fertilizer Manufacturing	1
Illumination Industrial	1
Infections	
Mattress Manufacturing	1
Inhalator for Resuscitation	5
Laboratory Equipment and Set-up	7
Noise Prevention	2
Occupational Diseases	
In Rayon Industry	1
In Telephone Repairing	1
Occupational Diseases, general	20
Prevention of Occupational Disease	6
Sanitation	3
Smoke Nuisance Wire Insulation	1
Steel Tempering	1
Ventilation	4
	66
Grand Total	264

Surveys or studies have been made, or assistance has been given in relation to the following substances, processes or conditions listed in our Hazard Classification (numbers refer to code numbers on Hazard Classification given in Annual Report of 1930):

2. Acids or Alkalis
4. Ammonia
5. Aniline or other Amino Comps.
8. Arsenic or Comps.
9. Benzol
10. Cadmium or Comps.
11. Carbon Disulphide
12. Carbon Monoxide
13. Carbon Tetrachloride
14. Chlorine
15. Chromium Comps.
16. Cutting Oils or Comps.
17. Cyanides
18. Dyes
19. Dust, Asbestos
20. Dust, Free Silica
21. Dust, Organic
22. Dust, N. O. C.*
23. Formaldehyde
24. Hydrogen Sulphide
25. Lead or Comps.
26. Methanol
27. Mercury or Comps.
29. Nitrogen Oxides
32. Phenol
37. Solvents (Dermatitis)
38. Sulphur Chloride
40. Sulphur Dioxide
44. Zinc (Dust or Fumes)
47. Trichlorethylene
48. Plating Solutions
58. Poisonous Substances, N. O. C.*
59. Infections, N. O. C.*
60. Buffing or Polishing
61. Dusty Process, N. O. C.*
62. Electroplating
64. Grinding
65. Sandblasting
67. Spray Coating
68. Tumbling
71. Molding (Foundry)
72. Rock Drilling
73. Welding
82. Temperature Extremes

This work was done in relation to the following industries listed in our Industrial Classification (given in Annual Report of 1930):

1. Abrasive Products Mfg.
2. Advertising Signs and Novelties Mfg., not exclusively wood, metal or celluloid
7. Arms Mfg. (small arms)
8. Artificial Silk Mfg.
9. Asbestos Goods Mfg.
13. Automobile Radiator Mfg.
14. Automobile Accessories Service Station
16. Battery Manufacturing
19. Brass or Copper Goods Mfg.
20. Brick and Clay Products Mfg.
23. Cable and Wire Insulating
30. Chemical Mfg. Involving: Toxic Materials within Completely Enclosed Systems
31. Chemical Mfg. Involving: Materials of slight toxicity
36. Composition Goods Mfg. (not containing nitrocellulose)
96. Contractors, all kinds, N. O. C.
41. Electroplating
44. Explosives Mfg. (incl. mfg. involving explosives)
46. Fertilizer Mfg.
49. Foundries, Iron or Steel
50. Foundries, Aluminum, Brass, or other Non-Ferrous Metals
54. Gas Works
97. Gasoline and Oil Bulk Station

* Not otherwise classified.

57. Hardware Mfg. (not otherwise classified)
58. Hat Mfg.—not straw or cloth
60. Hatters' Fur Mfg.
64. Lacquer Mfg.
66. Lead Works, sheet, pipe, shot (excl. smelting)
70. Machine Shops (incl. forging, excl. foundry)
71. Machinery Mfg. (not otherwise classified)
74. Office Machinery Mfg.
76. Paper and Pulp Mfg.
78. Printing, incl. Publishing, Lithographing, etc.
79. Quarrying
82. Rolling Mills—Brass, Copper, Aluminum
83. Rubber Goods Mfg.
87. Silverware Mfg.
89. Soap or Soap Powder Mfg.
91. Stone Cutting and Polishing
92. Textile or Textile Goods Mfg.
93. Textile Finishing, incl. bleaching, dyeing, etc. (not "Cleaning and Dyeing")
32. Tobacco Handling
95. Woodworking
110. Not otherwise classified
    Asphalt Mixing Plant
    Castor Oil Mfg.
    Crank Case Oil Refining
    Transportation

SUMMARY OF FIELD WORK

In view of the nature of the work conducted by this bureau, the major portion of the field activities was done in the more industrialized cities and towns. Although the towns in which field work was undertaken during the year, as given in the following list, are less than half of the towns and cities in the state, the population in these towns is appreciably more than half the inhabitants of the state.

Ansonia	Hamden	Putnam
Branford	Hartford	Rocky Hill
Bridgeport	Manchester	Salem
Bristol	Meriden	Springdale
Colchester	Middletown	Stamford
Danbury	Moodus	Stratford
Danielson	Newington	Thompsonville
Devon	New Britain	Wallingford
East Glastonbury	New Haven	Waterbury
East Norwalk	North Haven	Westport
Elmwood	North Westchester	West Haven

PLANT SURVEYS

Again this year many surveys were made at the request of industry. With the large number of these requests together with requests for consultations listed above and for technical studies, our limited personnel was unable to make complete surveys of any one of those industrial groups involving severe occupational disease hazards. The following list indicates the great diversity of our activities. These surveys cover 24 specific hazards found in 71 different types of operations and in addition general surveys of 12 industrial conditions.

SURVEYS OF INDUSTRIAL CONDITIONS PRESENTING POTENTIAL HEALTH HAZARDS

Types of Operations Involving a Specific Hazard	*Number*	*Totals*
Acids and Alkalis		
Ammonia—Refrigeration	1	
Caustic Soda—Rayon Mfg	1	
Storage Battery Divider Mfg	1	
		3
Carbon Monoxide		
Annealing	3	
In Buses	3	
Gas Producer Operation	1	
Operation of Gasoline Driven Tractor inside Manufacturing Plant	2	
Producer Preheater Building	1	
		10
Carbon Disulphide		
Rayon Washing	4	
Sulphuretting	2	
		6
Chrome		
Bleaching		2
Copper Fumes		
Welding operations		1
Dust		
Asbestos		
Beating	1	
Carding	1	
Grinding	1	
Molded Products Mfg	1	
Opening and Sieving Machines	1	
Picking	2	
Weaving	2	
Weaving (wet)	1	
Wire Insulating	1	
	11	
Foundries		
General Survey—All operations	7	
Molding Operations	2	
Sand Conditioning Machines	2	
Sandblasting	10	
Sand Slinger Operation	2	
Tumbling Barrels	1	
	24	
Machine Sanding (Wood Working)	1	
Quarrying		
Granite	2	
Trap Rock—Drilling Operations	2	
	4	
Talc and Soapstone—Buffing Rubber Goods	1	
		41
Dust, Organic		
Castor Pomace—Fertilizer Mfg	1	
Synthetic Resin Goods Mfg	1	
		2
Dyes		
Textile Finishing		1

Surveys of Operations Involving a Specific Hazard	*Number*	*Totals*
Electroplating		
Nickel, Copper, etc.		1
Formaldehyde		
Synthetic Resin Mfg.		
For Lacquer Mfg.	2	
For Composition Goods Mfg	2	
		4
Hydrogen Sulphide		
Spinning Rayon		4
Infection		
Glue Operation		1
Lacquer Dipping		
Application to Wire		1
Lead or Lead Compounds		
Brass Casting		
General Survey	1	
Motor Cleaning with Compressed Air Line	1	
Cleaning Transformer Gallery with Compressed Air Line	1	
	3	
Buffing	4	
Casting	4	
Linotype Operation	2	
Plate Milling	1	
Routing	2	
Rubber Compounding and Milling	1	
Sifting Lead Peroxide	1	
Soldering	2	
Type Casting	3	
		23
Lead Tetraethyl Gasoline		
Bulk Station Operation	1	
Filling Station Operation	1	
		2
Manganese Dioxide		
Preparation of Paste for Dry Cell Mfg		1
Mercurial Poisoning		
Carrotting		
By Hand 2		
By Machine 1		
	3	
Cutting Fur	1	
Fur Blowing	1	
Fur Mixing	1	
Hat Mfg. (Pouncing Dept.)	1	
		7
Noise Abatement		
Diesel Engine Operation		2
Solvents		
Benzol		
Rubber Cementing—Rubberized Goods Mfg	2	
Spray Painting	2	
	4	
Carbon Tetrachloride and Ethylene Dichloride—Wire Insulating	1	
Gasoline		
Cleaning Metal Parts	2	
Rubberized Asbestos Board Mfg	1	

Industries of Operations Involving a Specific Hazard	Number	Totals
Miscellaneous		
Trichlorethylene—Vapor Degreaser	2	
Lacquer Mfg.	2	
		12
Temperature Extremes		
Boiler Shop—Tank Welding		1
Total		125

General Surveys in Addition to Above

Air Filtering System	1	
Asphalt Mixing Plant	1	
Castor Oil Mfg.	1	
Cord Impregnation	1	
Crank Case Oil Refining	1	
Enamel Wire Insulating	1	
Fibre Board Mfg.	1	
Spray Painting	2	
Steel Rolling Mill	1	
Textile Twisting and Weaving	1	
Ventilation	1	
Ventilation Equipment	1	
Total		13
Grand Total		148

TECHNICAL STUDIES

Thirty-two technical studies of specific hazardous conditions were completed. These studies were conducted over a wide variety of conditions, eight specific hazards being investigated in connection with 22 different operations:

Conditions Studied	*No. of Studies*	
Carbon Monoxide		
Annealing Department	1	
Automotive Vehicle Operation	1	
Bus Operation	3	
Gasoline Tractor Operation (Inside Manufacturing Plant)	2	
Gas Heated Annealing Pot Operation	1	
Producer Gas Plant	1	
Producer Gas Preheater House	1	
		10
Cutting Oils (Irritative and Infectious Properties)		1
Dust		
Asbestos	1	
Foundry	2	
Granite Quarrying	2	
Rough Stone Production	1	
Sandblasting	2	
Trap Rock Quarrying—Drilling	2	
		10
Formaldehyde—Synthetic Resin Mfg.		2
Hydrogen Sulphide		1

Conditions Studied		*No. of Studies*
Lead		
Brass Casting Shop—Motor Cleaning Operation	1	
Novelty Casting and Buffing	1	
Printing	2	
		4
Mercury		
Carrotting Hatters' Fur		2
Solvent Vapors		
Benzol—Spray Lacquering	1	
Trichlorethylene	1	
		2
Total		32

TECHNICAL WORK

In conducting the technical work of the Bureau much information is obtained of value to those interested in occupational disease prevention. Certain of this information which can be divulged without violating confidences is presented below as an indication of the type of work done and also with the thought that this information may be of assistance in control of occupational disease hazards at other locations than those which were the subjects of the studies.

DUST HAZARDS

The dust hazard has been shown to be a serious factor in increase of morbidity and mortality. In the report of the Massachusetts Special Industrial Disease Commission, published February 1934, it was shown that 22.8 per cent of a representative group of 961 granite workers had developed silicosis and of these 7.6 per cent were complicated by tuberculosis. In a representative group of 1614 foundry workers, 11.4 per cent were found to have silicosis, 2.6 per cent of these complicated by tuberculosis. In this same report mortality statistics were given showing that the mortality rate for all granite workers was four and one-half times that of males twenty years and over. There is an excess of tuberculosis death also among the foundry workers. It was furthermore shown that pneumonia is the final cause of death in about one-fourth of all foundrymen, the rate for foundrymen being 23 per cent as against 8.5 per cent for all males twenty years and over.

In a report published recently by the Metropolitan Life Insurance Company of a foundry study in Wisconsin, similar results were found. Sixty-seven of the 215 X-ray films taken of workers in foundries were diagnosed as positive for silicosis. The report of the Committee on Group Mortality Investigations, published July 17, 1931, on the combined group mortality experience 1922-1930 (this being the mortality record of employees of industrial concerns insured under group life insurance contract written by six large American and Canadian Insurance Companies) showed that excessive mortality due to diseases incident to or caused by high dust exposure is by no means limited to any particular locality. More than one-third of all deaths among foundry workers were caused by some respiratory disease whereas but little more than one-fifth of the deaths

workers in other industries were due to these causes. The results of these recent studies provide additional information that excessive dust exposures have a marked effect on morbidity and mortality rates and that every effort should be made to control this condition.

Although the cost of injury to health by dust in terms of compensation payments is staggering, this compensation cost is by no means acknowledged the greatest cost to be ascribed to dusty conditions. Annual losses from claims made in Massachusetts for disability from dust inhalation averaged about $117,000 for 1929, 1930 and 1931. On September 10, 1931, the Wisconsin Compensation Commission had $600,000 of silicosis claims outstanding. In 1932 in that state about $207,000 was actually paid for occupational disease cases. In New York state a reputable authority reports a total of 1,000 to 1,500 suits for a total of $50,000,000. Claims which have originated in the last few years in various areas of this country aggregate a total of at least $300,000,000 for silicosis alone.

These figures are presented here to call attention to the fact that the dust hazard is one that should not be forgotten or postponed until a more prosperous industrial era develops. It is in the first interest of economy that effective steps be taken at the present time for the control of the dust hazard. One of the important factors from a public health point of view in connection with pneumoconiosis is that once well established the condition is progressive. Accordingly, the only preventive method is the control of dust producing operations so that exposure to dust will be less than that necessary to cause this disease.

In conducting the dust control work, 41 surveys of 19 dust producing operations, and 10 technical studies were made of 6 types of dust hazards. The work in furthering dust control should be greatly expanded. All manufacturers operating dusty processes should be fully informed of the existing hazard and of the methods of control. Surveys of dusty operations should be supported by technical studies which have been found so effective in the experience of the bureau for instigating action on the part of the manufacturer for control of the occupational disease condition.

ASBESTOS DUST HAZARDS

Asbestos is handled in appreciable quantities in eight plants operated by six concerns in this state. At four of these plants asbestos is received in the raw state; at the remaining plants, the asbestos is received as yarn. The principal products manufactured are woven and molded brake linings and clutch facing, and insulated wire for which asbestos is used as the insulation.

In the manufacture of asbestos products, the raw asbestos must first undergo certain preliminary operations. These preliminary operations present the greatest problem in dust prevention. However, dust determinations have shown that even the preliminary operations can be conducted without exposing workers to excessive dust concentrations. Evidence of the extreme dustiness in these operations is afforded by dust counts showing concentrations as high as 82 million particles per cubic foot of air in the asbestos preparation room and 76 million particles per

cubic foot of air in the carding room as against concentrations of only about one-half million particles per cubic foot of air in these two rooms in other plants where dust control measures have been successfully employed.

The necessity of providing dust control not only during normal operation but also during certain intermittent operations which may cause the liberation of excessive amount of dust into the air is well shown by the results of two dust samples collected in a preparation room of an asbestos products manufacturing plant. When the raw asbestos is fed into the opener too rapidly, the opener may become clogged at the outlet duct connected to the rear of the machine. A sample of air was being collected to show the dust exposure of the operator of the opener. During the collection of this sample the gate at the rear of the opener was removed to clean out the clogged duct. The opener was continued in operation during this time. It was found that the exposure of the operator during the collection of this sample was 16.7 million particles per cubic foot of air. The fact that the greater part of this dust resulted from the cleaning out operation was shown by a subsequent sample collected in this same room. During the collection of the second sample the duct at the rear of the opener remained closed. Not only was the opener itself being operated at this time, but also a screen which must have contributed some dust into the general room atmosphere on its own account. Even while both of these units were in operation, the exposure of the operator was found to be only 4.26 million particles per cubic foot of air. Although it is planned to reduce the dust content of this room even below this figure, this pair of determinations showed the advisability of impressing upon the operator the necessity of avoiding liberation of dust by removing the gate during operation of the opener.

Where scrap asbestos is to be used in molded products, it is necessary to send this scrap through a pulverizer. It was noted that dust escapes both at the pulverizer itself and also at the bag into which the pulverized asbestos is discharged. Here again unnecessary clouds of dust were given off in connection with an operation which was conducted intermittently. When the bag of pulverized asbestos became full, it was removed while asbestos continued to be discharged from the machine. The dust concentration at the breathing point of the operator as he conducted the entire cycle of operations in connection with the pulverizer including removal of the bag of pulverized material was found to be 10.3 million particles per cubic foot of air. As a result of these dust samples these conditions are to be taken care of and a further group of samples collected to show whether the control method has been effective.

TABLE NO. I. ASBESTOS DUST CONCENTRATIONS DURING PRELIMINARY OPERATIONS

Operation	*Dust Concentration in Million Particles per Cubic Foot of Air*
Plant No. 1 Preparation Room (Dust condition well controlled)	½
Plant No. 2 Preparation Room (Dust condition uncontrolled)	82
Plant No. 3 Exposure of operator of opener (Duct in rear open for cleaning during collection of sample)	17
Plant No. 3 (While screen in this same room was operating but duct in rear of opener was not open)	4

Dust conditions at carding machines, both feeders and finishers, tend to be severe excepting where particularly well designed exhaust ventilation is applied. Such ventilation must be close to the machine and so regulated that it does not pull the asbestos away from the machine. That this can be done successfully is shown by dust counts as low as one-half million particles per cubic foot of air in carding rooms. On the other hand where no ventilation or where poorly designed exhaust ventilation is used, dust counts as high as 76 million particles per cubic foot of air have been found.

The operations of spinning, twisting and weaving can be conducted without presenting excessive dust hazards as is shown by dust counts down to a third of a million particles per cubic foot of air in connection with each of these operations. However, it should be definitely determined by dust counts that such operations are being conducted without exposing the operator to a dust hazard in view of the fact that concentrations up to 10, 7 and 19 million particles, respectively, have been found.

In the manufacture of molded products, the raw opened asbestos or the pulverized scrap asbestos is first added to beaters of the type used in paper manufacturing. When the beaters are loaded by emptying the bags of material directly into them, an appreciable amount of dust is produced. A fifteen-minute air sample was collected at the breathing level of two men conducting this operation. During two minutes of this sampling period, bags of raw asbestos were being loaded into the beater. The rest of the load consisted of scrap asbestos which was being added during the greater part of the sampling period. Although higher dust concentrations were obviously being produced in loading the raw asbestos, a sample was collected throughout the loading of both these materials in order to be representative of this operation as it is usually conducted. The concentration of dust was found to be 13.6 million particles per cubic foot of air. It has been shown that this operation can be done without liberation of excessive amounts of dust. Until some method could be devised which does not involve escape of excessive amounts of dust at the plant where this high dust count was obtained, the expedient of providing the workers with respirators was suggested.

A sample of air was collected to show the exposure of workers cutting

out and inspecting clutch disks. The average exposure was found to be 4.4 million particles per cubic foot of air. No exhaust ventilation was provided in connection with this operation.

One of the major operations in the manufacture of molded asbestos products is grinding. Where exhaust ventilation is well designed, the dust concentration in the vicinity of grinding operations can be kept remarkably low. A group of six samples was taken at one plant in connection with various grinding machines. With a single exception, the ventilation was found to be adequate as shown by the results given in Table No. II.

Samples collected to show the exposures of operators of a Blanchard grinding machine, a Cincinnati grinding machine, and an internal boring machine were found to be 0.6 million, 0.8 million, and 2.0 million particles per cubic foot of air respectively. (Samples No. 1, 2 and 3, Table No. II.) It was noted that a small visible dust cloud was produced when the clutch disks were stacked prior to placing in the grinding machine. The concentration of dust from this source is however apparently insignificant in view of the very low dust counts obtained in samples No. 1 and No. 2. The ventilation system at each of these machines was shown to be effective in the removal of dust in these operations.

The fallacy of depending upon a visible cloud of dust as a criterion of the dust concentration is well evidenced by a pair of samples collected at an internal and at an external brake grinder. At one of the grinding wheels a visible cloud was produced which was not entirely removed by the exhaust system but escaped into the general room air in such a manner that the operator appeared to be exposed to an excessive dust hazard. To be sure the material was pressed against the grinding wheel hard enough to produce partial carbonization of the material but just how much of this cloud was smoke and how much of it was dust certainly could not be ascertained by mere inspection. From an observation of the condition it appeared essential to make this exhaust hood very much more effective. At another grinding wheel similar operations were being conducted but the temperature did not become sufficiently elevated to produce carbonization. The exhaust hood appeared to be fairly effective in the removal of the dust produced.

Samples of air were taken to show the exposure of the operators of each of these grinding wheels. The first grinder was found to be exposed to a concentration of four million particles per cubic foot of air. This dust count showed that the visible cloud was made up chiefly of smoke and only to a lesser extent of asbestos dust particles. The second grinder, on the other hand, was found to be exposed to 17 million particles per cubic foot of air. The operation which required first attention was obviously the latter but this situation became obvious only when dust counts were available. Incidentally this machine was a particularly difficult one to ventilate. An improved type of enclosure has been devised and it is planned to determine whether this is sufficiently effective to eliminate the dust hazards from this operation as has been accomplished with the other grinding operations at this plant.

In the operation of a lathe type grinder the operator was found to be exposed to only 1.7 million particles of dust per cubic foot of air, here again the ventilation being shown to be effective.

TABLE NO. II. DUST EXPOSURES OF OPERATORS OF GRINDING MACHINES

Sample No.	*Machine being operated*	*Number of Million particles per cubic foot of air*
1.	Blanchard Machine	0.6
2.	Cincinnati Machine	0.8
3.	Internal Boring Machine	2.0
4.	Internal Brake Grinder	4.
5.	External Brake Grinder	17.
6.	Lathe Type Grinder	1.7

In braiding and winding asbestos yarn on wire for insulation purposes, it appears that the dust hazards are not as great as those which we have been studying. Dust counts should be made however to determine just what dust concentrations exist in connection with these operations.

SILICOSIS HAZARDS

Granite Quarrying and Rough Stone Production

Granite quarrying and production of rough stone by plug drilling and splitting operations are looked upon generally as operations in which no appreciable dust hazard exists where these operations are conducted out of doors and not in enclosed sheds. A dust study was conducted in a surface granite quarry where rough stone was produced in this manner. The management thoroughly believed that no hazard existed but wished to have this assumption verified by a dust study.

Samples of air were collected to show the concentration of dust to which the men were exposed during drilling operations, during operations other than drilling, and also to show their average dust exposure throughout the entire cycle of operations.

Samples No. 1 and No. 2 (Table No. III) were collected to show how much dust was produced by the plug drilling operations. Sample No. 1 represented the exposure of the worker operating a plug drill. This sample was collected over a four-minute period and showed a concentration of 640 million particles of dust per cubic foot of air. Sample No. 2, collected simultaneously with Sample No. 1, was located in the dust cloud at a point six feet away from the operation. The concentration of 206 million particles per cubic foot of air found at this point represents the exposure to which any worker in the vicinity of the plug drilling operations might be subjected.

Sample No. 3 was collected to determine the exposure of a worker while engaged in operations other than drilling. A plug drill was being operated at a distance of three feet from this worker during two and one-half minutes of the ten-minute sampling period. Although this worker was at no time standing in the dust cloud arising from this operation, his exposure was found to be 16.8 million particles per cubic foot of air. The result of this sample showed that even though the operations are conducted out doors, much fine dust does remain suspended in the working area.

Samples No. 4 and 5 were taken to determine the exposure of each of two workers while engaged in the entire cycle of operations. During the