Silicosis and Dust Control

—*Vermont's Granite Industry*—

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VERMONT granite is a heterogeneous mixture of approximately 60 percent feldspar, 30 percent quartz, 15 percent mica, and 5 percent miscellaneous silicates. Quartz is, of course, the black sheep of the group of minerals which comprise this monumental stone.

Pneumatic tools came into general use between 1895 and 1900, accompanied by a tremendous increase in dust production over that produced by hand tools. Industrywide dust control for all dust-producing operations had its beginning in 1937. Hence, the period of greatest dust exposure in the Vermont granite manufacturing industry is about 40 years.

A Bench Mark

The year 1937 is a bench mark in the Vermont granite manufacturing industry. A program of dust control for all dust-producing operations was put into effect by the industry. A division of industrial hygiene was created in the Vermont Department of Health, and for many years it concentrated most of its efforts in improving working conditions in the industry. The division purchased a portable X-ray machine and began a yearly X-ray program, which is still in effect.

During the period 1924–26, dust exposures in this industry were reported by the Public Health Service to be about 1 to 200 million particles per cubic foot of air. Granite cutters who suffered the most severe exposure averaged an exposure of about 60 million particles per cubic foot of air (*1*). Since the beginning of plant-wide dust control in 1937, the dust exposure has been gradually reduced.

Recent dust counts in the industry indicate a general air dustiness of 1 to 2 million particles per cubic foot of air, with few individual operators exposed to greater than 5 million particles per cubic foot of air. Recirculation of dust collectors has been completely discontinued, and dry dust-producing operations in the industry are provided with an approved type dust collector. Every exhaust unit in the industry is inspected by the division of industrial hygiene at least twice a year, and detailed reports are sent to the individual manufacturer with a mandatory compliance order wherever corrections or improvements are necessary.

During 1937 and 1938 there was a very definite effort to encourage men to visit the division office for an X-ray at any time during their free hours. During that period, the division X-rayed 805 granite workers for the first time.

Mr. Ashe, director of the division of industrial hygiene, Vermont Department of Health, since 1946, served as program chairman of the American Conference of Governmental Industrial Hygienists, 1953–54, and as chairman, 1954–55. *This paper was presented at the 17th annual meeting of the conference in Buffalo, 1955.*

Table 1. Number of granite workers X-rayed, Vermont Department of Health, 1937–54

Year	Number X-rayed		
	First time	Re-checks	Total
1937	645	0	645
1938	160	211	371
1939	89	169	258
1940	90	155	245
1941	137	308	445
1942	83	251	334
1943	86	212	298
1944	38	183	221
1945	37	248	285
1946	109	235	344
1947	62	325	387
1948	203	452	655
1949	36	320	356
1950	239	698	937
1951	475	519	994
1952	209	1, 178	1, 387
1953	191	1, 262	1, 453
1954	131	1, 306	1, 437
Total	3, 020	8, 032	11, 052

From 1938 to 1950, evening clinics were held for granite workers in the division office. Results are shown in table 1. However, many men were not availing themselves of this service provided by the State of Vermont, and in 1950 arrangements were made with the various manufacturers to set up our portable X-ray machine in their establishments so that men could be X-rayed on company time. By this change of procedure, 937 and 994 men were X-rayed in 1950 and 1951, respectively.

Mobile X-ray Unit

During the summer of 1951 we conceived the idea of constructing a mobile X-ray unit whereby our X-ray machine could be transported to every shed in the area and our service offered to the men at a distinct saving to the manufacturer. This unit was put into service in the fall of 1951 with an increase in participation of about 400 men a year.

The 26-foot trailer consists of a small room in the rear for occupational histories, a darkroom for changing films, an X-ray compartment in the middle, and a dressing room in the front. A 3,000-watt, 220, 110-volt generator supplies the power, and a State-owned automobile provides the transportation. Lead-lined plywood is used in the interior construction to protect operating personnel from stray radiation.

This mobile X-ray unit, designed to X-ray men in dusty trades at their place of employment, was put into operation in September 1951. It has traveled 8,000 miles and taken 13,776 X-rays. The industries covered are granite, marble, slate (quarrying and finishing); asbestos (quarrying and milling); talc (mining and milling); copper (mining and processing); foundries (gray iron). The cost of the unit follows:

26-ft. Travelo trailer, custom built, with furnishings	$3, 072
Picker portable X-ray machine, 15 ma., 8-step voltage control, 14" by 17" plates	1, 350
Pass box, casette holder, casettes, and other accessories	805
3,000-watt Onan electric plant, installed	910
State-owned automobile, overload springs, trailer hitch, accessories	2, 727
Total cost	$8, 864

1937–1938

Approximately 2,400 men were employed in the Vermont Barre Belt granite manufacturing district in each of the years 1937 and 1938. Of the 805 men X-rayed, 365 had silicosis (45.3 percent); and 143 had silicosis with possible infection (17.9 percent).

All cases with definite X-ray evidence of nodular silicosis, whether it be early, moderately advanced, far advanced, or complicated with infection, are grouped together. In the category "silicosis plus possible infection," the infection is presumed to be tuberculosis. However, in these data (table 2) there has been no attempt to prove the existence of infection. It is very probable that a number of the men listed in this category have nothing more than a conglomerate silicosis. Some of them may have cavitation and positive sputa. For the purpose of this paper they are likewise grouped together.

1952–1954

The 3 years from 1952–54 have been taken for comparison with 1937–38 inasmuch as the

Table 2. Number of granite workers X-rayed and found to have silicosis, Vermont Department of Health, 1952–54

Number of men	1952		1953		1954	
	Number	Percent	Number	Percent	Number	Percent
On payroll	1,736		1,810		1,809	
Working, day of X-ray	1,616		1,786		1,691	
X-rayed	1,387	85.8	1,453	81.4	1,437	84.9
On payroll, previously X-rayed but not in indicated year	185		232		261	
On payroll, X-rayed at least once	1,572	90.6	1,685	93.2	1,698	93.9
Found with silicosis	274		253		219	
On payroll, diagnosis silicosis, X-rayed at least once, but not in indicated year	45		69		75	
On payroll, diagnosis silicosis	319	18.4	322	17.9	294	16.2
Found with silicosis plus possible infection	54		44		28	
On payroll, diagnosis silicosis plus possible infection, X-rayed at least once, but not in indicated year	4		18		14	
On payroll, diagnosis silicosis plus possible infection	58	3.3	62	3.4	42	2.3

mobile X-ray unit was in operation during these years, and the greatest cooperation was received from both employer and employee. The data in table 2 indicate the proportion of persons in the Vermont granite manufacturing industry who were X-rayed during these years and found to have silicosis.

The gradual decrease in the incidence of silicosis from a high of 45.3 percent in 1937 and 1938 to a low of 16.2 percent in 1954 may be attributed to two causes: dust control and silicotics leaving the industry for one reason or another. The incidence of silicosis with possible infection has been reduced from 17.9 percent to 2.3 percent over the same period.

The X-ray program began in 1937. Consequently, there could be no backlog of X-ray data then. Hence, the data for the years 1937 and 1938 cannot be compared on the same basis with data for the years 1952–54. However, we believe, the data presented here demonstrate an apparent striking decrease in the incidence of this occupational disease in a very hazardous industry. The majority of the 2,400 men employed in the industry in 1937 probably had more than 10 years experience; only 34 percent of these were X-rayed, and 45 percent of those X-rayed were found to have silicosis. It is generally believed that if it had been possible to examine the chest X-rays of every man employed in the industry at that time the incidence of silicosis might even have been higher. In 1954, for contrast, of all the men on the payroll, 18.4 percent were found to have silicosis (or 19.8 percent of those who had X-rays). Participating in the program, however, were 90.6 percent of the employees.

Summary

Our X-ray program started in 1937. Dust control started the same year and has gradually improved ever since. The State health department has not to this day discovered a case of silicosis in any man who has worked only in the Vermont granite manufacturing industry since 1937. It is our contention that this remarkable record is mainly due to effective dust control within the industry.

REFERENCE

(1) Russell, A. E., Britten, R. H., Thompson, L. R., and Bloomfield, J. J.: The health of workers in dusty trades. II. Exposure to siliceous dust (granite industry). Public Health Bulletin No. 187. Washington, D. C., U. S. Government Printing Office, 1929.