

## ASBESTOS DISEASE IN COMMERCIAL ROOFERS: RADIOLOGIC SIGNS

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Commercial roofers are mainly employed in constructing large flat roofs on relatively large buildings. There are two major processes involved: the removal, or "tear off," of an old roof prior to partial or complete replacement and the laying down of a new roof. Removal is often conducted down to the felt or insulation barrier. Initial tear-off involves use of a scratching machine, which has metal ribbed disks to break up the initial pitch gravel layer down to the felt and/or insulation. This is followed by a "power broom machine," which sweeps the gravel-pitch debris into wind rows on the roof. The gravel pitch is then shoveled by hand into small waste carts and transported to the side of the building for discarding via an enclosed chute to ground level. While loading the gravel pitch, the roof is scraped with shovels and other hand tools to assure that the surface is prepared for subsequent installation of a four-ply felt layer plus a top pitch-gravel layer. Removal of an entire roof entails using power claws and roof cutters to remove all layers, including insulation layers which may contain asbestos.

### MATERIALS AND METHODS

Local 3 of the Roofers International Union represents 453 active and retired roofers. It represents approximately 30 percent of commercial roofers in the Boston metropolitan area. In 1987, the union sponsored a medical group survey program for members. The program provided a physical examination, chest X-rays, spirometry and detailed occupational and medical histories. The program was offered on a voluntary basis to any active or retired member with 10 or more years of membership in the union. Data was collected in June 1987. Chest X-rays of all 69 participants were read by a radiologist with extensive experience with pneumoconioses (R.G.). The radiologist had no knowledge of individuals' exposure history, other than their employment as a roofer. Chest X-ray interpretation was reported according to the ILO/UC 1980 Classification of Radiographs of Pneumoconioses.<sup>1</sup> For the purposes of this study, a profusion grade of 1/0 or higher on the ILO scale was considered evidence of interstitial parenchymal fibrosis. Notations of pleural thickening, diaphragmatic pleural plaques, pleural calcification of the diaphragm or chest wall were all considered evidence of pleural disease.

The recorded occupational history would not allow characterization of exposure to asbestos; therefore, we used length of union membership as a surrogate measure. Union membership records were available for all 69 participants.

### RESULTS

The age distribution of the examined population was different from the membership as a whole (Table I). Two hundred and seventy-one, or 60% of the total membership, were members of the roofers for 10 or more years. Of these 271, 25% were examined in the survey. The members examined comprised more subjects in the 45-64 year age grouping, and less in the 25-34 year age group, than the union as a whole. The mean age of the examined population was 52 years, and mean number of years as a roofer was 29. The vast majority had more than ten years in the trade, with 74 percent having more than 20 years at the time of examination (Table II). Forty-six individuals, 67 percent of the population, had radiologic evidence of pleural disease (Table III). The mean age of this group was 54 years and mean years of membership 29 years. There was a significant relationship between years as a roofer and prevalence of pleural disease. Eighty percent of roofers with 20 or more years in the trade had evidence of pleural abnormalities, ( $\chi^2 = 4.7$ ,  $p < .05$ ).

In contrast, parenchymal abnormalities were uncommon, with only two (3 percent) individuals having radiologic evidence of fibrosis (Table IV). Both individuals with parenchymal fibrosis had more than 20 years membership in the union. There was no relationship between smoking status and the presence of pleural abnormalities (Table V).

### DISCUSSION

This cross-sectional survey found that 67 percent of roofers who participated had radiologic abnormalities characteristic of asbestos-related pleural disease. The prevalence of pleural abnormalities increased with years of union membership, i.e., duration of exposure and time since first exposure. These data support the conclusion that roofers, like other members of the construction trades, have sustained significant occupational exposure to asbestos and are therefore at risk for developing asbestos-related disease.

Eighty percent of roofers with 20 or more years of union membership had evidence of pleural disease, with two (2.5 percent) having evidence of parenchymal fibrosis (asbestosis).

The rate of pleural abnormalities in this population of roofers is substantially higher than those found in unexposed populations.<sup>2</sup> However, cross-sectional studies of other construc-

Table I  
Age Distribution of Union Membership and Roofers Examined

Age (Years)	Percentage of Union Union Membership (N = 288)	Percentage of Population Examined (N = 69)
0-24	3	0
25-34	23	4
35-44	17	16
45-64	42	71
65+	15	9
TOTAL	100	100

Table II  
Population Examined by Years of Union Membership

Years of Membership	N	Percentage
≤10	1	1
11-20	17	25
21-30	20	29
30+	31	45
	69	100

Table III  
Prevalence of Pleural Abnormalities

Years as Roofers	Number Examined	N	Percentage
≤10	1	1	-
11-20	17	8	47
20+	51	37	80
TOTAL	69	46	67

$\chi^2 = 4.7$ ,  $p < .05$  for prevalence < 20 years vs. > 20 years.

Table IV  
Prevalence of Interstitial Opacities

Years as Roofer	Number Examined	N	Percentage
≤10	1	0	0
11-20	17	0	0
20+	51	2	4
TOTAL	69	2	3

Table V  
Pleural Abnormalities and Smoking Status

	Number Examined	N	Percentage
Current	30	16	53
Ex-	30	23	77
Non-	9	7	78
TOTAL	69	46	67

$$\chi^2 = 3.25, p > 0.05$$

tion trades workers have revealed high prevalences of asbestos-related abnormalities, particularly pleural abnormalities. Baker et al. found pleural abnormalities in 70 percent of sheet metal workers who had 30 or more years of employment.<sup>3</sup> Sprince et al. found pleural thickening in 31 percent of a group of actual and retired pipefitters with more than 20 years since first exposure who attended a voluntary medical screening.<sup>4</sup> Michaels et al. reported that sheet metal workers with 20 or more years of union membership had a prevalence of 29 percent of X-ray abnormalities characteristic of pleural and/or parenchymal disease due to asbestos.<sup>5</sup> The differences in reported prevalences among construction workers in these studies is likely to result from differences in exposure among populations studied and differences in X-ray interpretation. Nevertheless, it is clear that asbestos-related abnormalities, predominantly pleural diseases, are prevalent in these populations.

This study is limited in two respects. First, relatively small numbers (i.e. 25% of eligible workers) limits accurate esti-

mation of prevalence. Second, the program was voluntary and it is therefore possible that disease status or exposure influenced participation.

The age distribution of participants differed from the union as a whole. However, reported prevalences of pleural and parenchymal abnormalities actually may be underestimates in the group with more than 10 years of exposure, since many non-participants were of retirement age in this group.

Benign pleural abnormalities resulting from exposure to asbestos include parietal pleural plaques along the chest wall and diaphragm, pleural calcification of plaques, diffuse visceral pleural thickening and rounded atelectasis. In addition, pleural effusions in the absence of malignancy have been described in asbestos-exposed workers, usually early in their careers.<sup>6</sup> All of these conditions (as well as the malignant manifestations of asbestos exposure) may be seen in roofers. Our data suggest that pleural abnormalities are extremely common in roofers with more than 20 years of work.

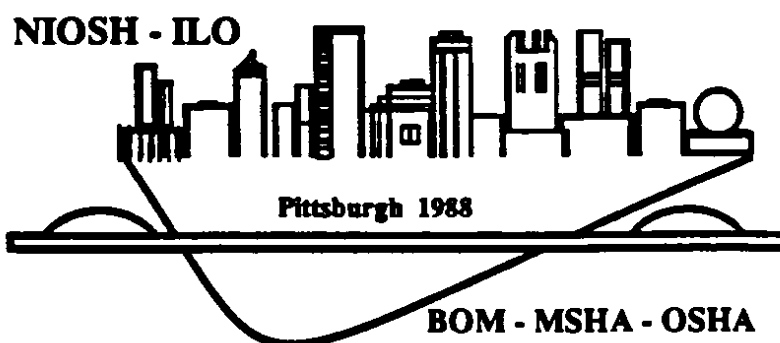
Our findings emphasize the need for medical surveillance of all asbestos-exposed construction workers. Our findings should also alert clinical practitioners to the type of radiologic abnormalities commonly seen among commercial roofers. Furthermore, while the OSHA standard mandates medical surveillance for currently exposed workers,<sup>7</sup> our data suggest that workers with past exposure and retirees be included in such programs. In addition, since the potential for on-going asbestos exposure exists during old roof removal, appropriate control of exposure needs to be rigorously implemented.

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*Proceedings of the VIIth International Pneumoconioses Conference*      *Part*  
*Transactions de la VIIe Conférence Internationale sur les Pneumoconioses*      *Tome*  
*Transacciones de la VIIa Conferencia Internacional sobre las Neumoconiosis*      *Parte*

**II**



Pittsburgh, Pennsylvania, USA—August 23–26, 1988  
Pittsburgh, Pennsylvanie, Etats-Unis—23–26 août 1988  
Pittsburgh, Pennsylvania EE. UU—23–26 de agosto de 1988



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**November 1990**

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**DHHS (NIOSH) Publication No. 90-108 Part II**