

additional potentially carcinogenic substances been identified among the other materials used.¹⁰

Heavier or even lighter exposure may result in different degrees of risk of neoplasia. Heavy factory exposure in the past has in some instances resulted in considerable lung cancer risk.¹¹ In others, paradoxically, little lung cancer was seen because asbestosis was so common and so severe as to cause death of the exposed workers before they could live long enough to develop lung cancer. Once exposure was reduced by improved industrial hygiene practices, early death from asbestosis sharply diminished and lung cancer became common.¹²

In any case, heavy exposure is not likely to be the most important problem in the future, unless there be sheer carelessness or unconcern. Rather, light exposure, similar to that in insulation work, will be much more common, both in direct asbestos working trades and as the result of indirect occupational exposure, as in the construction and ship-building industries.

There is another type of "light exposure" which may affect many more people than those industrially exposed. In the past several years, it has been demonstrated that asbestos bodies can be found in the lungs of 25% to 50% of adults examined at autopsy in large cities, such as Belfast, Northern Ireland, Capetown, Republic of South Africa, Miami, Fla, Pittsburgh, and Montreal. This is presumably due to "asbestos air pollution" by fibers derived from industrial "spillover" (as dust from construction sites or factory wastes) or from end-product use. Such community asbestos air pollution may be important since there is already evidence that in certain circumstances, as living within half mile of an asbestos plant or in the household of an asbestos worker, intimate environmental contamination can be associated with some risk of mesothelioma.¹³ What is not now known is whether the minimal amounts inhaled by the general public carry a similar risk.¹⁴

Nor do we know whether inhalation of the very small amounts of asbestos present in the air of some communities is associated with a special lung cancer risk in cigarette smokers (or, conversely, whether cigarette smoking makes the inhalation of very small amounts of asbestos particularly hazardous). It will be important to ascertain whether such cocarcinogenic or potentiating or precipitating relationships exist because, with the rapid growth of asbestos use (500,000 tons per year world production in 1930 has risen to over 4,000,000 tons per year now), it may be difficult for cigarette smokers to avoid inhaling air contaminated with asbestos.

It may not be easy to unravel the interrelationships which might exist between community asbestos air pollution and cigarette smoking. Both asbestos exposure and cigarette smoking have a long-lapsed period between onset of exposure and occurrence of neoplasia, yet for current smokers these two exposures may not have begun simultaneously; there was much less asbestos used 20 to

40 years ago. Youngsters who start smoking now have a much greater chance of having both exposures simultaneously.

Significance of Findings for Asbestos Workers.—The import of the data reported here seems clear. There is an extraordinary risk of developing and dying from lung cancer for asbestos workers who smoke cigarettes regularly. In the group studied, the combination of asbestos exposure and cigarette smoking increased the risk approximately 90 times compared with men who neither work with asbestos nor smoke!

Of 283 asbestos workers who had a history of cigarette smoking, 78 died within a period of 52 months whereas only 32.4 would have been expected to die within that length of time if their age specific death rates had been the same as for the general white male population of the United States. Of the 78 deaths, 24 (31%) were due to bronchogenic carcinoma. It is estimated that if these men had smoked cigarettes but had not been exposed to asbestos dust, only 2.98 would have died of bronchogenic carcinoma within the same length of time. If they had neither smoked nor been exposed to asbestos dust, only 0.26 would have been expected to die of the disease within a period of 52 months.

Of 87 asbestos workers who never smoked cigarettes regularly, none died of lung cancer within the 52-month period (although three died of asbestosis and one died of peritoneal mesothelioma). This finding, being based upon the experience of only 87 men, does not prove that exposure to asbestos dust has no influence on the risk of lung cancer among nonsmokers. However, it suggests that exposure to asbestos dust does not lead to an extremely high risk of lung cancer among nonsmokers.

The conclusions are evident:

1. Occupational exposure to asbestos dust should be reduced to as low a level as possible; but there may be an irreducible minimum level if asbestos, a very useful material, is to be used at all. Such reduction in exposure will benefit asbestos workers of the future. However, we are also concerned with workers who have already been exposed at significant levels for many years. Asbestos fibers will remain in their tissues for the remainder of their lives.

2. All people incur a great increase in risk of lung cancer if they smoke cigarettes; for asbestos workers the increase in risk is tremendous. Asbestos workers who do not now smoke cigarettes should never begin. Those who do smoke, should stop immediately. We may hope that the decrease in risk which results from cessation of smoking among the general public¹⁵ will be the good fortune of the asbestos workers as well.

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References

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2. Selikoff, I.J.; Churg, J.; and Hammond, E.C.: Relation Between Exposure to Asbestos and Mesothelioma, *New Eng J Med* 272:560-565 (March 18) 1965.