

TABLE 1
Deaths among 17,800 asbestos insulation workers
in the United States and Canada
January 1, 1967-January 1, 1977

Number of men Men-years of observation			17,800 166,855
	Expected*	Observed	
Total deaths, all causes	1,660.96	2,270	
Total cancer, all sites	319.90	994	
Lung cancer	105.97	485	
Pleural mesothelioma	**	66	
Peritoneal mesothelioma	**	109	
Cancer of esophagus	7.01	18	
Cancer of stomach	14.23	22	
Cancer of colon-rectum	37.86	59	
All other cancer	154.83	235	
Asbestosis	**	162	
All other causes	1,351.06	1,114	

* Expected deaths are based upon white male age specific mortality data of the U.S. National Center for Health Statistics for 1967-1976 and extrapolation to 1976.

** These are rare causes of death in the general population.

The membership of the International Association of Heat and Frost Insulators and Asbestos Workers, AFL-CIO, CLC, was enrolled on January 1, 1967, and has been observed since.

onstrate that enough asbestos exposure has occurred to produce such changes. In this sense, they are harbingers of future risk of clinical disease.

Tables 2-5 illustrate the characteristic latency of asbestos disease. In one group of 1,117 asbestos insulation workers in the New York metropolitan area, most of 725 workers with less than 20 years from onset of exposure (Table 2) had normal X-rays. When changes were present, they were minimal in extent. On the other hand, after the 20-year point, most X-rays were found to be abnormal, frequently exten-

sively so.⁴ Tables 3-5 show that few mesotheliomas and little excess cancer of the lung occurred less than 20 years from onset. Most occurred 30 or more years from onset of exposure. A young man may begin work at the age of 18; his risk of asbestos-associated cancer does not become substantial until he is 40, 50 or older.

EARLY STUDIES: MESOTHELIOMA IN SHIPYARDS

In 1968, the first warning that asbestos

TABLE 2
X-ray changes in asbestos insulation workers⁴

Onset of exposure (yrs.)	No.	% Normal	% Abnormal	Asbestosis (grade)		
				1	2	3
40+	121	5.8	94.2	35	51	28
30-39	194	12.9	87.1	102	49	18
20-29	77	27.2	72.8	35	17	4
10-19	379	55.9	44.1	158	9	0
0-9	346	89.6	10.4	36	0	0
Total	1,117	51.5	48.5	366	126	50

disease might be a serious problem in shipyards was sounded by Harries⁵ in Great Britain and Stumphius⁶ in the Netherlands when they reported instances of mesothelioma among shipyard workers. What was worrisome was that the men were not "asbestos workers" but rather, individuals employed in other trades. At the Devonport shipyard of the Royal Navy, for example, mesothelioma in a boilermaker, a fitter, a shipwright, a welder and a laborer were described.

This raised the important question of whether asbestos use in shipyards might result in the exposure of the workers employed in many trades, to dust derived from the few "asbestos workers" in their midst. In 1943, in the United States, for example, approximately one in 500 shipyard workers was an insulator. The other 499 included welders, shipfitters, machinists, pipefitters, electricians, boilermakers and painters (Table 6). The significance of this question is made apparent by the fact that during World War II, approximately 4,500,000 men and women worked in our shipyards, many of them under conditions in which exposure to asbestos was possible. After World War II the total number of shipyard workers rapidly decreased from a high of 1,700,000 in the last months of 1943 to 200,000 or so. During the period

of 1946-1976, total employment remained in this range, fluctuating with economic conditions and the country's shipbuilding program. The 200,000-250,000 figure characterized the total number in the yards at one time; however, there was much turnover, and the total number of different individuals was much larger. There are no accurate data readily available which could tell us how many different people—carpenters, riggers, electricians, draftsmen, welders, etc.—were so employed. Nevertheless, the early observations (soon augmented by later studies⁷⁻⁹) pointed to a potentially serious problem.

Harries has recently published his further observations at Devonport, through 1973.⁹ By the end of the year, he had observed 55 cases of mesothelioma in that shipyard alone. Again, trades other than "asbestos workers" gave evidence of the hazard. Only two of the 55 worked directly with asbestos (lagger, sprayer). The other 53 included 14 shipwrights, nine boilermakers, eight fitters and eight electricians (Table 7).

John Edge of High Carley Hospital has published similar data from shipyards in Barrow (Table 8)¹⁰; his most recent observations are particularly disturbing.¹¹ In Barrow, 429 individuals were seen, be-