

381

PV
J. G. Jones

MESOTHELIOMA OF PLEURA AND PERITONEUM FOLLOWING EXPOSURE TO ASBESTOS IN THE LONDON AREA

BY

MURIEL L. NEWHOUSE and HILDA THOMPSON

*From the Department of Occupational Health and Applied Physiology,
London School of Hygiene and Tropical Medicine*

(RECEIVED FOR PUBLICATION FEBRUARY 11, 1965)

A series of 83 patients from the London Hospital with a diagnosis of mesothelioma confirmed by necropsy or biopsy has been studied for possible exposure to asbestos. The series consisted of 41 men and 42 women; 27 of the patients had peritoneal and 56 pleural tumours. The earliest death recorded was in 1917, but only 10 of the series died before 1950 and 40 (48%) between 1960 and 1964.

76 of the series full occupational and residential histories were obtained. Forty (52.6%) gave a history of occupational or domestic (living in the same house as an asbestos worker) exposure to asbestos compared with nine (11.5%) out of 76 patients from the same hospital suffering from other diseases ($p < 0.001$). None of the 17 suspected cases of mesothelioma, rejected on pathological grounds, was found to have had any exposure to asbestos. There was also evidence that neighbourhood exposures may be important. Among those with no evidence of occupational or domestic exposures, 30.6% of the mesothelioma patients and 7.6% of the in-patients with other diseases lived within half a mile of an asbestos factory ($p < 0.01$). Out of the 31 patients with occupational exposures only 10 were in jobs scheduled under the Asbestos Regulations of 1931. The interval between first exposure and the development of the terminal illness of mesothelioma ranged between 16 and 55 years.

In 47 patients in the mesothelioma series, lung tissue or sputum was available for examination. In 30 (62.5%), either asbestosis or asbestos bodies were present.

In recent years, the association between exposure to asbestos dust and cancer of the lung and other malignant neoplasms has been the subject of much research (leading article, 1964). Wagner, Sleggs, and Marchand (1960) described the occurrence of mesothelioma of the pleura in those exposed to crocidolite asbestos in the mining districts of South Africa, and he has stimulated further studies of the occupational histories of patients suffering from this tumour (Owen, 1964; Fowler, Sloper, and Warner, 1964).

The present investigation concerns patients in whom mesothelioma had been diagnosed at the London Hospital during the past 50 years. After examining the necropsy and biopsy specimens held at the pathology department, Hourihane (1964) confirmed a diagnosis of mesothelioma in 83 patients, of whom 41 were men and 42 women. Thirty-one of the men had pleural tumours and 10 peritoneal;

among the women, 25 had pleural and 17 peritoneal tumours.

The aim of this study has been to establish the occupational histories of these patients and to trace any other possible exposure to asbestos. There were four surviving patients at the outset of the investigation, but these have subsequently died. The earliest date of death in the series was 1917; 10 died before 1950, 33 between 1950 and 1959, and the remaining 40 in the past four and a half years. The youngest patient died at the age of 33, and nearly half were dead before the age of 55 (Table 1).

Clinical Features

The ward notes of 65 of the patients were available and give a picture of a disease with a consistent symptomatology. Among those with pleural

ST0011806

PLAINTIFF'S
EXHIBIT

DOW-267

DOW 06018

TABLE I
AGE AT DEATH OF 13 PATIENTS WITH MESOTHELIAL
TUMOURS

Age (yr.)	Male		Female	
	No.	%	No.	%
<35	2	4.9	1	2.4
35-44	7	17.1	6	14.3
45-54	15	34.4	9	21.4
55-64	18	42.4	14	32.9
65+	7	17.1	8	19.0

tumours, the commonest presenting symptom was the rapid onset of extreme shortness of breath due to the formation of a massive pleural effusion. Pain was a prominent feature, either described as a dull ache, sometimes due to invasion of the ribs or vertebrae, or sometimes sharp and radiating, suggesting nerve involvement. Tumours in the chest wall were not uncommon, occurring either in previous operation scars or by direct invasion of the chest wall. The symptomatology of the peritoneal tumours was more varied. In some patients the presenting symptom was pain on defaecation or micturition. Diffuse upper abdominal pain was very common, and swelling of the abdomen due to ascites was always present terminally. The methods of treatment included pneumonectomy, decortication of the lung, deep x-ray therapy, instillation of radioactive gold, and cytotoxic drugs. They were used alone or in combination but had little effect on the course of the disease. Half of the patients suffering from pleural mesothelioma died within one year of the onset of symptoms, a further third within two years, and only one patient survived for more than three years. The course of those with peritoneal tumours appeared to be equally rapid. Eight of the patients died within six months of the onset of symptoms.

Sources of Information on Occupation and Residence

In addition to the ward notes, some of which gave good occupational histories, there were three other sources of information: the patient's general practitioner; the records of an asbestos factory in the area; and personal interviews with patients or their surviving relatives.

As a first step, general practitioners were circulated with an explanatory letter asking them to complete a form giving details of the occupations of patients and their immediate relatives. Within two months 65% of the doctors had replied. In two cases a hitherto unknown exposure to asbestos was revealed; in others the name and address of a surviving relative were given, but in the majority the doctor was unable to give information because, on the death of the

patient, the notes had been returned to the local executive council of the National Health Service, where they were destroyed within a period of three years.

In one of the asbestos factories a file was kept with detailed records of all employees since it started in 1913. The names of all patients were checked with these files. Nine men and nine married women (with their maiden names had been ascertained from relatives) were identified without difficulty. The exact dates of employment of these 18 patients and the jobs they had done were obtained from the records of the factory.

The four patients alive at the beginning of the investigation were interviewed personally. A few relatives were contacted by post, but the relatives of 68 patients were interviewed by one of us (H.T.) at their homes situated mostly in the East End of London. Not only was an occupational history of the patient, the spouse, sons and daughters, and father taken, but past addresses were also recorded. The interviews lasted for at least an hour. To recall events of 30 or 40 years ago it was often necessary to explore the residential and occupational histories of all members of the family.

Exposure to Asbestos in Three Groups of Patients Suffering from Other Diseases

For comparison with the mesothelioma patients, three further groups of patients suffering from other diseases were investigated.

The first group was selected from the patients in the medical and surgical wards of the hospital during the early summer of 1964 ('in-patient' series). Each patient in the mesothelioma series who had been traced was matched with an in-patient of the same sex born in the same five-year period. As there was a dearth of male patients over 75 years of age in the hospital, a sample of six patients of this age and older was taken from a neighbouring geriatric hospital.

The second group were those who had originally been filed in the pathology department of the hospital as cases of mesothelioma but in whom the diagnosis was subsequently rejected on pathological grounds by Hourihane (1964) ('rejecter series'). As it had proved extremely difficult to locate the relatives of those who died before 1950, attempts were made only to trace the three survivors in this group and the 14 who died after 1950.

The in-patient series, already described, were all admitted to hospital in 1964. The patients with mesothelioma were admitted to the same hospital over a period of 47 years during which there might have been a substantial change both in the residential

and social classes of patients attending the hospital. Thus, a third group of patients was taken from the hospital records matched by age of admission as well as date of birth and sex with the patients in the mesothelioma series. Their place of residence and occupations were extracted for comparison with those of the in-patient series.

Results

Details of the 33 patients in the mesothelioma series are given in the Appendix. No information about past domestic and occupational histories was available for seven patients. Among the remaining 26 (52.6%) gave a history of exposure to asbestos compared with only nine (11.8%) of the 'in-patient' series (Table 2). The difference in this proportion is

TABLE 2

TYPE OF EXPOSURE TO ASBESTOS OF 26 PATIENTS WITH MESOTHELIOMA AND 26 IN-PATIENTS WITH OTHER DISEASES

Type of Exposure	Mesothelioma Series		'In-patient' Series	
	No.	%	No.	%
Employed at one asbestos factory	1	2.9	1	1.3
Employed at other asbestos factories	4	5.3	1	1.3
Landscaping and forestry	8	10.5	4	5.3
Relative worked with asbestos	9	11.8	1	1.3
Others handling asbestos	0	—	2	2.6
No history of work or domestic exposure to asbestos	16	47.4	67	88.2

Positive exposures to asbestos in mesothelioma series versus other diseases in in-patient series.

$$\chi^2 = 27.11, P < 0.001$$

*Seven cases of mesothelioma could not be traced and are omitted from this table.

statistically highly significant ($\chi^2 = 27.11$; $P < 0.001$). This result is unlikely to be unduly influenced by the two groups of patients not being matched for year of admission to hospital, since there was no significant difference either in the areas of residence or in the occupations of the patients admitted in 1964 and those admitted between 1917 and 1964. Comparing the confirmed and rejected patients in the mesothelioma group who died after 1950, 36 (50%) of the confirmed and none of the 17 rejected cases gave a history of exposure to asbestos (Table 3). This difference is statistically highly significant ($\chi^2 = 11.83$; $P < 0.001$).

TABLE 3

EXPOSURE TO ASBESTOS OF CONFIRMED AND REJECTED CASES OF MESOTHELIOMA SURVIVING AFTER JANUARY 1950

Exposure to Asbestos	Diagnosis of Mesothelioma	
	Confirmed	Rejected
Exposure positive	36	0
No work or domestic contact (found)	33	14
Untraced	1	1

$$\chi^2 = 11.83, P < 0.001$$

Mesothelioma Series

Occupational Exposures.—There are details available for the 18 mesothelioma patients who had worked at one asbestos factory which used crocidolite asbestos with small amounts of chrysotile and first introduced amosite in 1926. Eleven started work before 1933 (the year when the asbestos regulations controlling the manufacture of asbestos goods and the protection of asbestos workers became effective), and seven started work between the beginning of 1933 and the end of 1942. The occupations of these workers and the type of asbestos they used are shown in Table 4. All of the 17 for whom details were available had used crocidolite asbestos. Five of the occupations listed are not scheduled as

TABLE 4

JOB OF 17 PATIENTS WITH MESOTHELIOMA EMPLOYED AT ONE ASBESTOS FACTORY

Statutory Obligations	Job	Male	Female	Material
Subject to regulations	Spinning	0	4	Crocidolite
	Carding	1	1	Crocidolite
	Clothing and weaving	1	0	Crocidolite, chrysotile, amosite
	Disintegrating and opening	2	1	Crocidolite, chrysotile, amosite
Not subject to regulations	Filter making for A.R.P. masks	2	0	Crocidolite
	Manufacturing of preformed pipe insulation	1	1	Crocidolite
	Manufacturing of brake linings	1	0	Crocidolite
	Rubber compounding	0	1	Crocidolite, chrysotile
	General labourer	1	0	Crocidolite, chrysotile, amosite

*Employment history not available for one female patient.

ST0011808

requiring medical supervision under the Asbestos Regulations (1931).

Four patients were working at other factories making all types of asbestos goods. One had been employed in a wagon works sawing asbestos sheets for partitions. Except for one, a woman employed in insulating electrodes with crocidolite, the types of asbestos used in these other factories are not known.

The eight heating engineers and ladders were all men. Three had been employed in dockyards on ship repairs, two in various types of lagging, one in a power station, one installing hospital sterilizing equipment, and one installing central heating. All were consistently employed on this type of work for more than 20 years, but, in some, exposure to asbestos was intermittent.

Domestic Exposures.—The group of nine, seven women and two men, whose relatives worked with asbestos, are of particular interest. The most usual history was that of the wife who washed her husband's dungarees or work clothes. In one instance a relative said that the husband, a docker, came home 'white with asbestos' every evening for three or four years and his wife brushed him down. The two men in this group, when boys of 8 or 9 years old, had sisters who were working at an asbestos factory. One of these girls worked as a spinner from 1925 to 1936. In 1946 she died of asbestosis. The press report of the inquest states: 'She used to return home from work with dust on her clothes'. Her brother had apparently no other exposure to asbestos; he started work as a shop assistant, then became a sawyer of iron girders until 1948 when he worked as a loader of groceries in the docks for five years (but never on dusty cargoes) and then returned to sawing iron girders. He died in 1956 of a pleural mesothelioma.

In-patient Series

Occupational and Domestic Exposures.—Two of this series had worked in asbestos factories and four had been employed as ladders. The husband of another was employed at an asbestos factory for three years, and two dockers in this group gave histories of handling asbestos cargoes from time to time throughout their working life.

The diagnoses of these patients have been grouped into seven categories (Table 5). The patients with a positive history of exposure are scattered throughout the various diagnostic groups, and there is no indication that exposure to asbestos could be related to the disease which had caused their admission.

Neighbourhood Exposures of Mesothelioma and In-patient Series.—The 36 patients with meso-

TABLE 5
DISEASE GROUPS OF PATIENTS IN THE IN-PATIENT SERIES

Disease Group	No. of Patients	No. with Exposure to Asbestos
Cardiovascular	21	3
Mesothelioma	9	0
Respiratory-endothelial (including asbestosis)	8	2
Gastro-intestinal (excluding cancers)	6	2
Respiratory (excluding cancers)	3	0
All neoplasms	18	1
Other	11	1
Total	76	9

thelioma and the 67 patients in the 'in-patient' series, who had neither an occupational exposure nor a relative living in the home working with asbestos, might have been exposed to asbestos dust because they lived in the immediate vicinity of an asbestos factory.

One factory, where more than one-fifth of the mesothelioma patients were employed, opened in 1913, having been situated nearer the centre of London for the previous seven years. There were three affected female patients living within half a mile of the factory during the time it was in production at its first site. When it opened they were children between 5 and 7 years old. At the present site, there were eight patients living within a half-mile radius of the factory. One man was born within a quarter of a mile of the factory and remained at the same address for 16 years. The other seven were women, and all except one were children when the factory opened. The seventh was 23 years of age and remained in the same house until she died 48 years later. She is the only patient who had neither occupational nor household exposure but in whom asbestos bodies were found in the lungs at necropsy.

Among the 'in-patient' series, one patient lived near the factory at its previous site and four others lived near its present site. One patient was 22 years old when she moved into the neighbourhood in 1915. She disliked it and, when interviewed, complained impartially about the dust from the asbestos factory and the rats in the house.

TABLE 6
RESIDENCE OF PATIENTS WITH NO OCCUPATIONAL OR DOMESTIC EXPOSURE TO ASBESTOS

Series	Lived Within 1 mile of Asbestos Factory		Lived More Than 1 mile from Asbestos Factory		Total
	No.	%	No.	%	
Mesothelioma	11	30.6	23	69.4	34
In-patient	5	7.3	62	92.7	67

$$\chi^2 = 7.85, P < 0.01$$

ST0011809

Among those with no occupational exposure to asbestos, there are 11 (30.6%) in the non-mesothelioma series and five (12.5%) in the 'in-patient' series who lived within half a mile of an asbestos factory in the area (Table 6). There was no evidence of asbestos bodies in the sputum of patients in the 'in-patient' series who lived in the vicinity of the factory and no other exposure to asbestos is statistically significant ($\chi^2 = 7.85$; $P < 0.01$).

Date of First Exposure and Interval Before Death in Mesothelioma Series.—Fifty-one men and women were exposed to asbestos, including those who worked in the main asbestos factory. The duration of exposure varied widely, ranging from two months to over 50 years. The interval between the first exposure and death varied between 16 and 55 years (mean 37.5 years). Among the group of factory workers, where exposure was probably heaviest, the interval was shortest. It was longest among the group living in the neighbourhood of the asbestos factory, where exposure to dust was probably least. Table 7 shows the mean age of each group at first exposure and the mean of the interval before death in each group. Although the length of interval

Lung tissue was available in only four patients exposed either through relatives or by living in the neighbourhood of asbestos factories. In two, asbestos bodies were present in lung tissue but there was no evidence of asbestosis.

TABLE 8

EVIDENCE OF ASBESTOS BODIES OR ASBESTOSIS IN 47 CASES OF MESOTHELIOMA WITH LUNG TISSUE OR SPUTUM AVAILABLE FOR EXAMINATION

History of Contact with Asbestos	Asbestos or Asbestos Bodies		Lung Tissue not Available
	Present	Absent	
Positive	22	4	23
Negative	4	8	11
Untraced	4	5	6
Total	30	17	24

Among the 12 patients in whom no definite contact with asbestos could be established, there was one, a merchant seaman from South Africa, whose lungs showed both asbestos bodies and asbestosis; he may have had contact either in South Africa or at sea, but his early history could not be established. There were three others in this group who had asbestos bodies in lung tissue without evidence of asbestosis.

Of the seven patients whose histories could not be traced, three had asbestos bodies and histological evidence of asbestosis and one had asbestosis alone.

TABLE 7

RELATION BETWEEN TYPE OF EXPOSURE AND LENGTH OF INTERVAL BEFORE DEATH IN 51 PATIENTS IN MESOTHELIOMA SERIES

Type of Exposure	No.	Mean Age at First Exposure (years)	Mean Interval between First Exposure and Death (years)
Factory work	21	22.5	29.4
Domestic workers and housewives living in neighbourhood of factory	8	19.6	36.4
Living in neighbourhood of factory	11	38.5	48.6

varied between 29.4 and 48.6 years, the mean age at death showed less variation; it was 50.6 years in the group of factory workers and between 55 and 57 years in the other groups.

Asbestos Bodies and Asbestosis in the Mesothelioma Series.—Of the 53 patients in the mesothelioma series, lung tissue was available for examination in forty-three. In four other patients, all certified as suffering from asbestosis, with no lung tissue available, examination of sputum during life revealed the presence of asbestos bodies (Table 8). Both asbestos bodies and histological evidence of asbestosis were found in 15 of the 24 factory workers and laggards. A further five showed evidence of either asbestos bodies or asbestosis.

Discussion

In the mesothelioma series there are 25 patients in whom no evidence of any exposure to asbestos could be found. A chief source of information was a history taken from a surviving relative. A surprising amount of information was obtained, but in some of those interviewed the memory may have been defective or they may not have known of short periods of exposure during the youth of the deceased. For example, one of the patients was eventually identified as having worked at a large asbestos factory for two months in 1941. This was before he married, and his widow did not know of this episode. It is of interest that asbestos bodies in the lungs were found in only four of this group, and it seems probable that among the remainder there were those who had had no exposure to asbestos.

In the mesothelioma series of patients, both industrial and non-industrial exposures were recognized. Among the men the exposure was predominantly industrial; 22 worked in asbestos factories or as laggards, two were exposed at home, and one lived near the asbestos factory. Among the women only 10 worked in asbestos factories, and a

ST 0011310

further 17 had non-industrial exposures, seven in the home and 10 living near asbestos factories.

There is no evidence that the patients with peritoneal tumours differed in their type of exposure from the patients with pleural tumours. The proportion of positive findings of asbestos bodies or asbestosis was similar in both groups. A higher proportion of women, particularly among the factory workers, was affected by peritoneal tumours, but the difference between the sexes was not statistically significant.

The recent increase in the number of patients diagnosed at the hospital may be partly due to an increased interest in mesothelial tumours and partly to the long interval between first exposure and development of the tumour. Those exposed between 1915 and 1925 might be expected to die from about 1950 onwards. Asbestos imports to the United Kingdom have mounted steeply since 1932 (Leathart, 1964) and its uses are more widely diversified in industry. The increasing proportion of the population exposed to asbestos during the past 30 years may be expected to give rise to an increasing occurrence of mesothelial tumours.

The choice of groups for comparison with the mesothelioma series of patients was not ideal. The number of patients it was possible to trace in the 'rejected' series proved to be very small. The 'in-patient' series, although matched for date of birth and sex, differed from the mesothelioma series in that all were admitted to hospital during 1964. Neither of these groups could be interviewed without knowledge of the disease from which they were suffering. This could have led to bias with under-reporting of exposure to asbestos in the in-patient series. However, in the 'in-patient' series the actual patient was interviewed, and more detailed and reliable histories were obtained than was possible from the relatives of those who had died of mesothelial tumours. There was no evidence that, because of their more recent admission to hospital, the in-patient series was less

likely than the mesothelioma series to have contact with asbestos or to live in closer proximity to asbestos factories.

There seems little doubt that the mesothelioma may arise from both occupational and domestic exposures to asbestos. Warner *et al.* (1960) described patients with no exposure other than living as a child in the vicinity of the mines. A high incidence of asbestos plaques in the pleura has been found in the population in an anthophyllite mine in Finland (Kiviluoto). More evidence is required of an increased risk to a population living in the neighbourhood of factories or other areas, such as dockyard, where asbestos is used in quantity.

We should like to thank Dr. D. O'H. Hourigan for co-operation and for making the results of investigations available to us.

Our thanks are also due to Professor C. Professor V. W. Dix, Dr. N. L. Rusby, and Dr. F. R. C. S., of the London Hospital and St. Matthew's Hospital for permission to view their patients; to the general practitioners who collaborated in this enquiry; to the management of asbestos factories for arranging access to them; to Miss Joan Wallford for statistical assistance; Dr. J. C. Gidwin, Professor R. S. F. Schilling, and Dr. Smith for their advice and help.

The contents of this paper were communicated at a Conference on the Biological Effects of Asbestos arranged by the New York Academy of Sciences, October 1964, and will be published in a short form in the proceedings of that conference.

REFERENCES

- Forster, P. B. S., Slaper, J. C., and Warner, E. C. (1964). *J. 2*, 211.
 Leading article (1964). *ibid.*, 2, 261.
 Kiviluoto, H. (1964). *Ann. 19*, 265.
 Kiviluoto, H. (1964). *Acta Pathol. (Scand.)*, 194.
 Leathart, G. L. (1964). *Quart. Revs. (Lond.)*, 10, 119.
 Owen, W. G. (1964). *ibid.*, 10, 214.
 Wagner, J. C., Slaper, J. C., and Marshall, P. (1964). *ibid.*, 10, 265.

ST0011811

MESOTHELIOMA OF PLEURA FOLLOWING EXPOSURE TO ASBESTOS 267

APPENDIX

SEVENTY-THREE PATIENTS WITH MESOTHELIAL TUMOURS

Case No.	Site of Tumour	Sex	Year of Birth	Year of Last Exposure (years)	Duration in Years	Year of Death	How Diagnosed	Asbestos Bodies in Lung Tissue	Presence of Asbestosis in Lung Tissue	Survival from Initial Symptoms (months)	Relevant History
Group A: Factory workers											
1	Pleura	M	1911	1921	10	1940	Necropsy	Positive	Positive	7	Boiler maker, boiler coverer, asbestos factory; mainly crocidolite
15	Peritoneum	M	1895	1919	24	1941	Necropsy	Positive	Positive	7	Disintegrator and other jobs, asbestos factory; amosite, crocidolite, chrysotile
18	Peritoneum	F	1904	1925	21	1947	Biopsy	Positive (epithelial)	N/A	7	Asbestos pipe maker, asbestos factory, crocidolite asbestos, mainly crocidolite
24	Pleura	M	1888	1924	36	1950	Necropsy	Positive	Negative	9	Lead asbestos handling in factory, asbestos construction
40	Peritoneum	F	1891	1917	26	1951	Necropsy	Negative	Negative	7	Asbestos factory, job unknown
46	Peritoneum	F	1904	1922	18	1951	Biopsy	Positive (epithelial)	N/A	7	Charger and asbestos pipe maker, asbestos factory, crocidolite asbestos; amosite, crocidolite, chrysotile
48	Peritoneum	F	1894	1915	21	1954	Necropsy	Positive	Positive	12	Spinner, asbestos factory, crocidolite asbestos; mainly crocidolite
51	Peritoneum	F	1895	1917	22	1955	Biopsy	Positive (epithelial)	N/A	3	Asbestos pipe maker, asbestos factory, crocidolite asbestos; mainly crocidolite
53	Peritoneum	F	1901	1918	17	1955	Biopsy	Positive (epithelial)	N/A	4	Spinner, asbestos factory, crocidolite asbestos; mainly crocidolite
59	Peritoneum	F	1897	1919	22	1956	Necropsy	Positive	Negative	3	Disintegrator, asbestos factory; amosite, crocidolite, chrysotile
61	Pleura	M	1891	1928	37	1957	Biopsy	N/A	N/A	18	Asbestos maker, north England asbestos factory
62	Peritoneum	F	1918	1917	2	1958	Biopsy	N/A	N/A	18	Cable, asbestos factory; mainly crocidolite
71	Peritoneum	M	1898	1927	29	1958	Necropsy	Positive	Positive	18	Clothing and weaving, asbestos factory; amosite, crocidolite, chrysotile
72	Peritoneum	M	1925	1940	15	1958	Biopsy	N/A	N/A	3	Fiber maker for A.R.P. masks, asbestos factory; mainly crocidolite
73	Pleura	M	1925	1941	16	1959	Biopsy	Negative	Negative	11	Fiber maker for A.R.P. masks, asbestos factory; mainly crocidolite
74	Peritoneum	F	1907	1921	14	1959	Necropsy	Negative	Negative	7	Iron trade coverer; crocidolite
17	Pleura	F	1910	1924	14	1962	Biopsy	Positive	Negative	7	Spinner, asbestos factory; mainly crocidolite
6	Pleura	M	1907	1942	35	1962	Necropsy	Positive	Positive	7	Disintegrator chemicals in asbestos factory; amosite, crocidolite, chrysotile
49	Peritoneum	F	1899	1923	24	1963	Biopsy	Positive	Negative	3	Spinner, asbestos factory; mainly crocidolite
1	Pleura	M	1899	1934	35	1963	Necropsy	Positive	Positive	7	Laboratory, works and buildings, asbestos factory; amosite, crocidolite, chrysotile
23	Pleura	M	1908	1925	17	1963	Necropsy	Positive	Negative	8	Worked in part of insulating construction
3	Peritoneum	M	1911	1918	7	1963	Necropsy	Positive	Positive	6	Cable, asbestos factory; mainly crocidolite
4	Peritoneum	M	1917	1937	20	1964	Necropsy	Positive	Positive	24	Disintegrator and other jobs, asbestos factory; amosite, crocidolite, chrysotile
Group B: Lagger and welder											
14	Pleura	M	1894	1908	14	1915	Necropsy	Negative	Negative	12	Worked in close proximity to boiler repairs in dockyard
25	Pleura	M	1893	1910	17	1933	Biopsy	N/A	N/A	24	Boiler cleaner and stripper, dockyard
22	Pleura	M	1921	1937	16	1939	Necropsy	Positive	Positive	9	Boiler coverer and lagger in various firms
30	Pleura	M	1908	1923	15	1941	Biopsy	N/A	N/A	25	Erecting and fitting central heating
27	Peritoneum	M	1908	1923	15	1941	Necropsy	Positive	Positive	12	Boiler coverer and pipe welder, constructing firm
26	Peritoneum	M	1911	1927	16	1941	Necropsy	Positive	Positive	13	Lagger and boiler coverer, various firms
34	Pleura	M	1897	1916	19	1942	Biopsy	N/A	N/A	8	Intermittently boiler lagger, ship repairs
29	Pleura	M	1912	1927	15	1942	Biopsy	N/A	N/A	10	Insulation of hospital warming apparatus

(continued)

DOW 06024

ST0011812

APPENDIX (continued)
 INDUSTRIAL PATIENTS WITH METASTATIC TUMOURS

Case No.	Site of Primary Tumour	Sex	Year of Birth	Year in which Lung Examined	Year of Death	How Diagnosed	Asbestos Index in Lung Tissue	Plasma Index in Asbestos in Lung Tissue	Survival since Initial Symptoms (months)	Personal History	
Section C: Exposure of relatives											
40	Pleura	M	1912	1925	11	1956	Biopsy	N/A	N/A	27	After water worked as labourer in asbestos factory, and then continued as such.
34	Pleura	F	1913	1919	2	1957	Biopsy	N/A	N/A	44	After water worked as sprayer, and after that as a painter.
38	Pleura	F	1895	1919	41	1960	Biopsy	N/A	N/A	51	For several years worked in a small asbestos factory, and after that in a large factory.
37	Pleura	F	1925	1925	14	1950	Biopsy	N/A	N/A	1	After water worked as a labourer, and then continued as such.
35	Peritoneum	F	1890	1921	21	1950	Necropsy	Positive	Negative	20	After water worked as a labourer, and then continued as such.
33	Pleura	F	1914	1930	4	1961	Necropsy	Negative	Negative	7	After water worked as a labourer, and then continued as such.
39	Pleura	M	1919	1925	2	1961	Biopsy	N/A	N/A	16	After water worked as a labourer, and then continued as such.
32	Pleura	F	1908	1941	3	1963	Biopsy	N/A	N/A	18	After water worked as a labourer, and then continued as such.
36	Peritoneum	F	1839	1912	18	1963	Biopsy	N/A	N/A	15	After water worked as a labourer, and then continued as such.
Section D: Neighbourhood cases											
44	Pleura	F	1905	1913	7	1959	Biopsy	N/A	N/A	8	Lived within 1 mile of parent on asbestos factory.
45	Pleura	M	1922	1922	16	1950	Biopsy	N/A	N/A	17	Lived within 1 mile of parent on asbestos factory.
42	Pleura	F	1819	1913	48	1961	Biopsy	Positive	Negative	15	Lived within 100 yards of parent on asbestos factory.
50	Pleura	F	1903	1908	6	1961	Biopsy	N/A	N/A	12	Lived within 1 mile of old site of asbestos factory.
43	Pleura	F	1905	1913	13	1961	Biopsy	N/A	N/A	4	Lived within 1 mile of parent on asbestos factory.
47	Pleura	F	1917	1917	10	1961	Biopsy	N/A	N/A	16	Lived within 100 yards of parent on asbestos factory.
64	Pleura	F	1899	1907	6	1962	Biopsy	Negative	Negative	3	Lived within 1 mile of old site of asbestos factory.
71	Pleura	F	1879	1907	6	1962	Biopsy	N/A	N/A	12	Lived within 1 mile of old site of asbestos factory.
41	Pleura	F	1910	1913	32	1962	Biopsy	N/A	N/A	20	Lived within 1 mile of parent on asbestos factory.
48	Pleura	F	1904	1913	7	1962	Biopsy	N/A	N/A	9	Lived within 1 mile of parent on asbestos factory.
46	Pleura	F	1907	1913	7	1963	Biopsy	N/A	N/A	7	Lived within 1 mile of parent on asbestos factory.
Section E: No history of contact with asbestos											
65	Pleura	F	1908		1947	Necropsy	Positive	Negative	7	Worked as a nursemaid to manage at her work in the London district, and then continued as such.	
68	Peritoneum	F	1902		1954	Necropsy	Negative	Negative	3	After water worked as a labourer, and then continued as such.	
69	Pleura	M	1895		1954	Biopsy	N/A	N/A	7	After water worked as a labourer, and then continued as such.	
75	Pleura	F	1899		1955	Biopsy	N/A	N/A	7	After water worked as a labourer, and then continued as such.	
76	Peritoneum	F	1904		1955	Necropsy	Negative	Negative	27	After water worked as a labourer, and then continued as such.	
63	Pleura	M	1899		1955	Necropsy	Negative	Positive	28	After water worked as a labourer, and then continued as such.	

ST001813

CONFIDENTIAL

N/A = data not available.