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4 March 2013



Dear Mr Wilson

Having spoken with you about your concern regarding health and safety and the handling of anti-gas respirators, I have been looking through my files in an attempt to clarify the situation.

Whilst it has been established that blue asbestos (crocidolite) had been used as a component in the manufacture of filters it is known that resin wool filters were used as a substitute from 1940. However, as you will see by reading the copies enclosed of various reports it is apparent that this is a grey area, and therefore the question of what is safe and which is not is difficult to establish in broader terms.

The reports would appear to agree that the British issue child's 'Mickey Mouse' respirator, the infant's gas helmet, and the series of civilian respirators up to the C7 type are all suggested to be safe, in other words free from asbestos as part of their make-up. However, some information contradicts this stating that the some of the adult civilian masks used filters that did contain blue asbestos!

Given that the Museum by a standard procedure blocks all such Second World War filters by sealing them with resin, irrespective of type, we feel that this is the most effective internal means to combat risk. We also undertake when asked, to provide information with regard to safe handling of these items as part of our wider public service. But from your point of view it is the trading of these masks/filter combinations without concern of the potential dangers that is the concern and that it is apparently is being done so without monitoring on popular internet-based auction sites. Certainly it is my personal opinion that a health warning of some description ought to be appearing to the forefront in such trading and that the auction sites should recognise that there is a responsibility.

Indeed if you carry out an internet search under, "asbestos & gas masks" you will find one optional title that is worth reading, under <http://www.collectors-club-of-great-britain.co.uk/Features/Gas-Mask-Dangers/ft793>. This is written by the 'Collectors Club of Great Britain', and offers a form of a well-intentioned appraisal of the situation but is still short of being a more structured means to inform the end user of the potential hazards.

All I can do is to share with you the information that I have to hand in the hope that there is something that you find here of use.

Do feel free to contact me further should you wish.

Yours sincerely

A handwritten signature in black ink, appearing to read 'MB', with a long horizontal flourish extending to the right.

Martin Boswell  
Curator Uniforms, Personal & Field Equipment, and Flags



EASTERN  
GAS

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Tel: Potters Bar 51151  
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Our ref: RJ/SG

20th January 1986

M J R Allen Esq  
Deputy Keeper  
Department of Exhibits and Firearms  
Imperial War Museum  
Lambeth Road  
London SE1 6HZ

Dear Mr Allen

Herewith returned the service issue respirator, World War II period. I would apologise for the delay in returning the equipment, my expected display was cancelled.

I was able to obtain an analysis of the filter material and photographs of the canister disassembled. The filter is basically in two parts. The upper, being the majority of the bulk, is of a granular carbon material. The lower part is a fibre pad containing blue asbestos (crocidolite). The construction of the filter would make it unlikely that respirable asbestos fibres would pass through during normal use. However, fibres can be released from the air intake parts during handling or storage. Consequently caution should be taken by persons handling these canisters.

I have enclosed several photographs to illustrate the components of the canister, with notes on a photocopy. I hope these can be of interest.

Many thanks for extending to me the opportunity to examine the respirator. If I can be of any assistance to you in the future then please contact me.

Yours sincerely



R Johnson  
REGIONAL SAFETY ADVISER

*Mr Keith Francis.  
Standards & Safety Manager.*





Procurement Executive Ministry of Defence

## CHEMICAL DEFENCE ESTABLISHMENT

Porton Down Salisbury Wilts SP4 0JQ

Telephone Idmiston 610211 ext 342  
(STD 0980)

Mr S R Lugg  
11 Cole Hill  
Worcester  
WR5 1DG

Please reply to The Director  
Your reference

Our reference Ptn/AT1904/TIIS

Date 7 December 1984

Dear Mr Lugg

Thank you for your letter of 28 November about gas masks and your article for "Mother" magazine on dangerous articles in the home.

Your sources are correct in stating that gas masks issued to the civilian population during WWII contained asbestos, but there is no evidence that feather down was used. The asbestos was of the blue variety. However, it is clear that not all civilian gas masks contained asbestos; some contained instead a wool-resin layer.

The asbestos, when it is present, is solely in the cylindrical black-laquered metal canister which is attached to the rubber facepiece by a wide rubber band. Under normal conditions of storage and use the canister is quite safe. At its outer end, where the air is drawn in, a series of wire gauzes, muslin diaphragms and cotton pads sandwich a particulate filter element firmly against a layer of charcoal granules which occupy the remainder of the canister and which extends to the inner end, which is closed by a further layer of gauze, muslin, cotton pads and a compression spring. Thus, the various elements of the canister are held firmly together. The particulate filter is where the asbestos is present; this part of the canister is designed to remove finely divided toxic smokes. The compression and patency of the canister entirely prevents disruption of the asbestos and the deep layer of charcoal presents a further barrier to inhalation of asbestos fibres.

However, this only applies to canisters which are properly used. Should the canister be considerably misused by hammering, crushing, heating or waterlogging then internal disruption may allow the release of asbestos. If the damaged canister is still attached to the respirator facepiece, then subsequent wearing could bring the risk of inhaling asbestos. If the damaged canister is not attached, then vigorous disturbance or use as a football, could well allow asbestos to escape. If this occurs indoors, then the possible hazard is obviously increased.

Asbestos is likely to be present in the canisters of not only the WWII civilian mask but in any older UK gas mask and in many foreign masks. Its use in UK gas masks was discontinued many years ago but there is no simple way in which you can distinguish or your readers those older gas masks which could present an asbestos hazard if used.

The essential points which you need to make are probably these:

Many old respirators may contain asbestos in their canisters.

Generally, if the canister is intact, there is no risk of asbestos being released because the history of storage and handling may not be known to the current owner, canisters should be regarded as potentially hazardous.

3. Old gas masks should not be worn.
4. Gas masks or their canisters should not be given to children as toys.
5. If old gas masks are stored by collectors of militaria or as souvenirs or memorabilia, they should ideally be kept in sealed polythene bags.
6. Unwanted gas masks or canisters should be sealed in plastic bags and disposed of; if necessary through local environmental health inspector. Gas mask canisters should not be broken up or burnt on domestic premises.

At the same time, we would not wish to overstate the dangers of old gas masks. Most will be quite safe if the canisters are intact and they are properly used. Old gas mask canisters represent a minute fraction of the possible every day sources of asbestos hazards and they should not be unduly highlighted. Such highlighting could cause some readers to speculate that they were exposed to an asbestos hazard when their WWII respirators were issued, tested and worn in practice drills. This is not so; there was no such hazard.

I hope this information will be of use. If you need more specific information on WWII gas masks this may be available from the Home Office at 50 Queen Anne's Gate, London SW1H 9AT.

A useful source of reference, which has diagrams of the WWII civilian respirator and its canister is Air Raid Precautions Handbook No 1. 3rd Edition entitled "Personal Protection Against Gas" HMSO 1944. You may be able to borrow a copy from the Ministry of Defence Central Library or the Imperial War Museum through your local library.

Yours sincerely

*G B Carter*

G B CARTER  
H/TIIS  
for Director





Procurement Executive Ministry of Defence

## CHEMICAL DEFENCE ESTABLISHMENT

Porton Down Salisbury Wilts SP4 0JQ

Telephone Idmiston 610211 ext 487  
(STD 0980)

Mr A H Kirkman  
Borough Environmental Health Officer  
Poole Central Clinic  
Civic Centre  
Park Road  
POOLE  
Dorset BH15 2RT

Please reply to The Director

Your reference RDD/WAR 27 Nov 85

Our reference Ptn/TD3001/1806/85

Date 20 December 1985



Dear Sir

### CIVILIAN RESPIRATORS CIRCA 1935-42

Thank you for your enquiry concerning the use of asbestos fibrous materials in filter canisters for respirators. I am sure that you will appreciate that this Establishment was primarily concerned with research and development aspects rather than with procurement which, for civilian respirators, was the responsibility of the Home Office. Civilian respirators were produced at many factories throughout the country until the mid fifties.

Investigation into the limited records we have on this topic and examination of historic canisters shows that several types of material were used including blue asbestos (crocidolite)/Wool, asbestos (Chrysotile)/Wool, resin wool and feather-down. There is good evidence to show that resin wool filters were produced from 1940 onwards and it is implied that production of resin wool canisters for civilian respirators may have started in 1939. Examination of canisters for civilian use in infant, children (Mickey Mouse type) and civilian respirators up to the CV 7, all show resin wool filter material.

Examination of canisters for both civilian and civilian duty respirators dated 1937 and 1938 show the presence of chrysotile asbestos mixed with wool fibres. The records show that such canisters were produced up to about 1942 when they were superseded by resin wool. These canisters were identical in size to those fitted to the infant and civilian respirators so there is a significant statistical probability that some infant and child respirators (other than the Mickey Mouse type which had a different design) could have been fitted with asbestos/wool canisters containing chrysotile. However, the probability cannot be estimated with any confidence.

In view of the hazard posed by chrysotile asbestos we would recommend that you review your collection of canisters. If you wish to retain the asbestos/wool canister for display purposes we suggest that the item be kept in a closed display case so that it is not handled, worn or cut open. Alternatively, we would be prepared to exchange the asbestos/wool canister for a resin wool canister of later date but identical design so that you have a wholly safe display item.

Please contact us if we can be of further assistance in this matter.

Yours faithfully

D G UPSHALL  
Superintendent  
Physical Protection Division  
for Director

TYPE 12/4/10

-131 054 HSELINE 82001127

CONCENTRATIONS AND CHARACTERISTICS OF AMPHIBOLE CROCIDOLITE IN THE  
BRITISH GAS-MASK FACTORIES, AND ELSEWHERE, DURING THE SECOND WORLD  
WAR

Morgan, A.; Holmes, A.

British Journal of Industrial Medicine. 1982, vol.39, no.1, Page:  
62-69.

UDC: 616-006.6; 677.51

Concentrations and length distributions of uncoated and coated  
amphibole fibres in the lungs of various workers after death were  
measured. All but two of the workers had died with a mesothelial  
tumour. There were to be no relation between latent period and fibre  
concentration. Discusses the significance of the wide range of fibre  
concentrations associated with the development of mesothelial  
tumours, and the relation between relative frequency and dimensions  
of uncoated and coated fibres.

? T12/4/11

TYPE 12/4/11

-131 015 HSELINE 82000074

MORTALITY OF FEMALE GAS MASK ASSEMBLERS

Wignall, B.K.; Fox, A.J.

British Journal of Industrial Medicine. 1982, vol.39, no.1, Page:  
34-38.

UDC: 312.2; 616-006.6; 677.51

A 30 year follow-up study of the mortality of 500 women employed  
in manufacturing gas masks during the second world war showed a  
pronounced excess of deaths from mesothelioma and lung cancer.  
Although the women were subject to short periods of exposure,  
greater excesses were found for those exposed for between one and  
five years, than for those exposed for less than a year. An excess  
of deaths from cancer of the ovary was also found, and considered to  
be related to exposure to asbestos.

? /



D G Upshall Esq  
Superintendent  
Physical Protection Division  
Chemical Defence Establishment  
Porton Down  
Salisbury  
Wilts SP4 0JQ

Your ref:Ptn/TD3001/1806/85  
MJRA/EXH/JN  
23 January 1986

Dear Mr Upshall

We have recently been in touch with Mr A.H. Kirkham the Environmental Health Officer for the Borough of Poole, concerning the use of asbestos fibrous materials in the filters of respirator canisters. He has very kindly sent to us a copy of your letter relating to this matter.

We do have in our collections a number of respirators from both the First and Second World War periods. For a very long time now we have been anxious about the display and use of respirators where members of the public are concerned.

In the light of the information contained in your letter would it be possible for us to identify the filter canisters which contain chrysotile asbestos as opposed to the ones containing resin wool. Also would it be possible for us to obtain from you six of this latter type of canister for our schools collections which are held at Duxford Airfield, HMS Belfast and also at the main building in London. This would ensure that our more tactile collection of respirators will be entirely safe.

We would be most grateful to have your views on this matter and we look forward to hearing from you in due course.

Yours sincerely

M J R Allen  
Department of Exhibits & Firearms



## Mortality of female gas mask assemblers

B K WIGNALL<sup>1</sup> AND A J FOX<sup>2</sup>

From the Department of Radiology,<sup>1</sup> St George's Hospital, and Department of Mathematics,<sup>2</sup> The City University, London, UK

**ABSTRACT** A 30-year follow-up study of the mortality of 500 women employed in manufacturing gas masks during the second world war showed a pronounced excess of deaths from mesothelioma and lung cancer. Although these women were subject only to short periods of exposure, greater excesses were found for those exposed for between one and five years than for those exposed for under one year. Even in the latter group, however, five deaths from lung cancer and four deaths from mesothelioma were recorded compared with 1.5 deaths and 0.1 deaths expected ( $p \approx 0.02$ ). An excess of deaths from cancer of the ovary was also found, and this appeared to be related to exposure to asbestos.

As part of a study of textile workers exposed predominantly to crocidolite asbestos, Knox *et al*<sup>1</sup> included one of the earliest reports on the mortality of female employees. The number of deaths recorded in their study was twice that expected, and the authors suggested that the health of female asbestos workers should be further investigated. At the same time Newhouse and Thompson<sup>2</sup> described an investigation into patients in whom a diagnosis of mesothelioma had been made at necropsies. Seventeen women in their series were found to have been occupationally exposed to asbestos, principally crocidolite. The exposure was in general less than six years, and there was a long interval between first exposure and onset of mesothelioma. In 1972 Newhouse *et al*<sup>3</sup> reported on a prospective mortality study of women who had manufactured asbestos textiles and insulation materials. This study showed an excess of mortality mainly due to cancers of the lung and pleura, which was most pronounced for women exposed to asbestos for more than two years.

When a Nottingham woman died in 1965 and a postmortem examination showed a pleural mesothelioma, it was suspected that she had been occupationally exposed to asbestos and this prompted a search of the employee files at a local factory where she had worked. The patient was one of about 1600 workers, almost all women, who had, during the second world war, assembled gas masks mainly destined for the armed Forces. In May 1972 Jones<sup>4</sup> (at a meeting of the British Division of the Inter-

national Academy of Pathology at Wolverhampton) reported that 10 women who had developed mesothelioma had been doing this work. The number had risen to 26 by 1976.<sup>4</sup>

These observations on the incidence of mesothelioma at this factory led one of us (BKW) to identify and trace a group of female employees who had worked in a particular part of the plant where military gas masks were made and who, by the nature of their work, were considered likely to have been exposed to higher concentrations of crocidolite asbestos than the remainder of the work force. By means of a follow-up of this group at the National Health Service Central Register using a prospective study design we were able to determine the total mortality experience of the group and to relate the observed patterns to measures of exposure to crocidolite. In a parallel study, Jones *et al*<sup>5</sup> reported on the incidence of cancer in the total work population, including all those employed in all stages of the assembly of both civilian and military gas masks.

### Methods

#### POPULATION STUDIED

Scrutiny of company records showed that between 1939 and 1944 about 1600 employees, almost all women, had assembled gas masks. After 1940, production was mainly of military masks, one of which was obtained and dismantled. It contained filter pads that analysis showed to consist of merino wool mixed with 15% pure crocidolite asbestos.<sup>3</sup> The crocidolite proved to be an uncommon variety, a very fine fibre type mined in Western Australia. From

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information provided by retired management, it seemed likely that only those employees who weighed filter pads or who clamped them into holders would have been directly exposed to asbestos dust. Despite the exhaust ventilation of the assembly lines, these women reported that by the end of the working day they were covered in fluff from the pads.

Therefore, for the purpose of this study, only these women plus those working in the same room were selected for tracing and analysis. This group numbered 535 (table 1), only one-third of the group covered by Jones<sup>3</sup> but nevertheless a sub-group with more precise exposure data.

Table 1 Number of women covered by the study and outcome of trace, 1 January 1978

Outcome of trace	Women	
	No	%
Total on lists	535	100
Traced	500	93
Alive	354	66
Dead	138	26
Emigrated	8	1
Not traced	35	7
Insufficient identification	18	3
Not found at NHSCR	17	3

NHSCR = National Health Service Central Register.

Relevant departmental wage sheets for the years 1939-44 were obtained from the payroll department, and these contained the surname, initials, marital status, and date of birth of each employee, and indicated whether she was employed full-time or part-time. The personnel and industrial health records were used to provide christian names, any change of surname by marriage, and home address as well as dates of joining and leaving the company and dates of transfer between departments. The latter records were incomplete but were used to identify those women who had been employed on the production of military masks.

Identification details for all women were then submitted to the Office of Population Censuses and Surveys' National Health Service Central Register, which reported the vital status of individuals in this group and forwarded coded copies of death certificates for all women who had died. Of the 7% of women not found in the NHSCR, more than half lacked adequate identification details to enable a proper search to be made. Just over a quarter of the population had died in the period under study.

### Exposure

In general, the wage sheets indicated only the building in which women had worked without

referring to the actual work done. Before 1942, however, women who weighed and clamped pads were paid directly by the chief inspector of armaments and were designated "CIA" on the wage sheets. These women constitute our high asbestos exposure subgroup.

Of the other women on these wage sheets, some had been employed on a separate floor and solely on face-piece assembly—for example stitching webbing and fitting eye pieces. Between 1965 and 1970 one of us (BKW) attempted to contact those women still alive to obtain an indication of this work. On the basis of this follow-up, these women were separated for the period 1971 onwards into three subgroups: those who had handled the pads or had worked in the same room (definitely exposed to asbestos), those who had never been so employed (definitely not exposed), and those who were not contacted or who did not remember their exposure.

### Duration of employment

"Duration of employment" is used here to indicate the period spent working on one or other of the processes mentioned above. It excludes periods working in other departments before or after employment on gas mask filter assembly. Table 2 indicates that 35% of those 384 women for whom employment records were complete were employed for under six months; only 4% were exposed for over five years. Studies of people exposed for such short periods to high concentrations of asbestos are of particular interest for the light they shed on the latency from exposure to effect.

Table 2 The distribution of women, in particular those paid by the chief inspector of armaments (CIA workers), by duration of employment

Duration of employment (months)	All women	CIA workers
< 5	133	20
6-11	70	17
12-17	40	8
18-23	44	8
24-35	54	7
36-47	24	2
48-59	5	3
≥ 60	14	1
Not known	116	—
Total No	500	66

### Results

Observed and expected deaths in the period 1951-77 are given in table 3 by cause of death. Overall mortality was a little below expected (SMR 96), but mortality from all cancers (SMR 177  $p < 0.01$ ) and, in particular, cancer of the lung (SMR 273  $p < 0.01$ )



Table 3 *Observed and expected deaths 1951-77 by cause*

Cause of death (ICD range)	Deaths		
	Observed	Expected	SMR
All cancers (140-209)	64	36.2	177
Cancer of lung (162)	10*	3.7	273
Cancer of stomach (151, 2, 3, 4)	7	10.7	65
Cancer of breast (174)	7	8.0	88
Mesothelioma (158, 163)*	12‡	0.2	7500
Cancer of ovary (183)*	6	2.8	213
Circulatory diseases (390-458)	43	68.9	63
Respiratory diseases (460-519)	11	14.6	76
Bronchitis (490-493)	3	4.4	68
Asbestosis (515-2)	1	—	—
Accidents and violence (800-999)	7	4.7	148
All causes	133	139.0	96

\*One cancer of the ovary was found on histological examination to be a mesothelioma of the peritoneum.

†In addition there was one cancer of larynx in 1977.

‡Includes one intrathoracic carcinoma in 1962, coded to ICD 163.9.

and mesothelioma (SMR 7500  $p < 0.01$ ) was raised. Mortality from circulatory and respiratory diseases was low.

Table 4 indicates that the excess from lung cancer was greatest in the younger age groups whereas that for mesotheliomas was spread across the age groups. Of the 12 deaths from mesothelioma observed, seven were in women aged over 65.

Table 4 *Observed and expected deaths by cause and age*

Cause of death	Age		
	25-54	55-64	65-74
All cancers			
Observed	19**	18	27**
Expected	9.463	12.695	13.986
SMR	201	142	193
Lung cancer			
Observed	4*	4	2
Expected	0.809	1.481	1.373
SMR	494	270	146
Mesothelioma			
Observed	3**	2**	7**
Expected	0.039	0.067	0.057
SMR	7692	2985	12281
All causes			
Observed	23	37	73
Expected	22.623	35.208	81.201
SMR	102	105	90

\* $p < 0.05$ , \*\* $p < 0.01$ .

As might be expected from other studies of industrial cohorts<sup>6</sup>, mortality in the early period of follow-up was low (table 5). Although from this table the pronounced excess from mesothelioma appears to have come in the 1960s while that from lung cancer was observed only in the 1970s, table 6 indicates that this simply reflects the small number of cases. Table 5 also suggests an excess of other cancers that may be found in the late 1970s.

Table 5 *Observed and expected deaths by cause and period of study*

Cause of death	Period of study		
	1951-60	1961-70	1971-77
All causes			
Observed	12**	56	65
Expected	26.05	53.65	59.34
SMR	46	104	110
All cancers			
Observed	5	27**	32**
Expected	8.09	14.45	13.61
SMR	62	187	235
Lung cancer			
Observed	—	3	7**
Expected	0.54	1.43	1.69
SMR	—	209	414
Mesotheliomat			
Observed	—	6**	6**
Expected	0.03	0.07	0.06
SMR	—	8775	10107
Other cancers†			
Observed	5	18	19
Expected	7.52	12.95	11.86
SMR	66	139	152

\*\* $p < 0.01$ .

†One cancer of the ovary in 1967 was found on histological examination to be a mesothelioma of the peritoneum.

Table 6 *Deaths from cancer of the lung and mesothelioma by year of death*

Year of death	Person years at risk	Deaths from	
		Cancer of lung	Mesothelioma
1951-61	5333	—	—
1962-64	1412	1	1
1965-67	1368	1	2
1968-70	1304	1	3
1971-73	1230	2	3
1974-77	1500	5	3

In table 7 deaths are separated according to exposure to asbestos. Mortality for the CIA workers, those definitely exposed to asbestos from the early 1940s, was higher than for the other groups. The overall SMR for the group was 208 ( $p < 0.01$ ) and comprised SMRs of 625 for lung cancer ( $p > 0.05$ ), 15 000 for mesothelioma ( $p < 0.01$ ), and 1481 for cancer of the ovary ( $p < 0.01$ ). The group with the next highest mortality was those women who, although not CIA workers, were confirmed as exposed to asbestos. Although their overall SMR was only 112, these women recorded pronounced excesses of cancer of the lung and mesothelioma. It should also be noted from the table that five deaths from cancer of the ovary were found among women definitely exposed to asbestos (0.63 expected), whereas none was found among those definitely not exposed (0.40 expected).

Table 8 describes an attempt to relate mortality to duration of employment. Clear relationships of higher SMRs are seen for overall mortality and for

Table 7. Observed and expected deaths by cause and exposure to asbestos

Cause of death	Exposure to asbestos														
	CIA† 1951-77			Not CIA‡ 1951-70			Asbestos‡ 1971-7			Not asbestos‡ 1971-7			Asbestos not known‡ 1971-7		
	Obs	Exp	SMR	Obs	Exp	SMR	Obs	Exp	SMR	Obs	Exp	SMR	Obs	Exp	SMR
All cancers	15**	3.04	493	23	20.79	111	17	5.31	320	7	5.77	121	2	1.24	161
Lung	2	0.32	625	3	1.82	165	5**	0.64	781	—	0.72	—	—	0.16	—
Mesothelioma*	3**	0.02	15000	4	0.09	4444	5**	0.02	22261	—	0.03	—	—	0.01	—
Ovary*	4**	0.27	1481	1	1.70	59	1	0.36	278	—	0.40	—	—	0.09	—
All causes	18**	8.66	208	58	75.14	77	28	25.08	112	27	25.04	108	2	5.12	39

\*One cancer of the ovary in the CIA group was found on histological examination to be a mesothelioma of the peritoneum.

\*\*p < 0.01.

†CIA workers were paid by the chief inspector of armaments and were heavily exposed to asbestos.

‡Women on lists were initially classified as "CIA" and "not CIA." In 1965-70 an attempt was made to trace women and to discover whether or not the jobs performed implied that they had been exposed to asbestos. Therefore from 1971 onwards the "not CIA" could be separated according to asbestos exposure into (a) known asbestos exposure, (b) known not exposed, and (c) not known whether or not exposed.

Table 8. Mortality of women employed for under five years who were alive six years after entry to the industry by duration of employment

Cause of death	Duration of employment				
	< 1 year	1 year	2 years	3 years	4 years
All causes	52	27	17	8	2
Observed	55.34	26.19	14.68	6.54	0.62
Expected	94	103	116	122	323
SMR					
All cancers	24	15	7	7	2
Observed	14.49	6.52	3.90	1.42	0.23
Expected	166	230	179	493	870
SMR					
Lung cancers	5	2	1	1	—
Observed	1.47		1.19		
Expected					
Mesotheliomas*	4	3	1	3	1
Observed	0.07		0.05		
Expected					
Ovarian cancers*	2	2	—	1	—
Observed	1.13		0.95		
Expected					

\*One cancer of the ovary in the one year employment group was found on histological examination to be a mesothelioma of the peritoneum.

cancers in particular. Once the deaths are separated into more specific causes, however, the numbers expected are too few for stable estimates of the SMRs to be obtained.

Nevertheless, for both mesothelioma and cancer of the ovary mortality would appear to be higher in women exposed for one year or more than in women exposed for less than one year. The same pattern with duration of exposure is found for the CIA workers, although this is now based on even fewer deaths (table 9). The table is interesting because the SMRs even for those exposed for less than one year are considerably higher than those shown in table 8.

Table 9. Mortality of CIA workers who were employed for less than five years who were alive six years after entry to the industry by duration of employment

Cause of death	Duration of employment					
	Less than one year			One year to four years		
	Obs	Exp	SMR	Obs	Exp	SMR
All causes	7	4.95	141	11**	3.63	303
All cancers	7**	1.71	409	8**	1.12	714
Lung cancer	2*	0.19	1053	—	0.14	—
Mesothelioma†	1	0.00	∞	2	0.00	∞

\*p < 0.05; \*\*p < 0.01.

†In addition one cancer of the ovary in the one to four year exposures group was found on histological examination to be a mesothelioma of the peritoneum.

Table 10 points to a difference in mortality between those women who left the firm in 1942 or 1943 and those who left in 1944; the former group.

Table 10. Mortality of women employed for less than five years who were alive six years after entry to the industry by duration of employment and year of leaving the company

Year of leaving company	Duration of employment					
	Less than one year			One year to four years		
	Obs	Exp	SMR	Obs	Exp	SMR
1942 or 1943						
All causes	23	21.90	105	22	18.12	121
All cancers	13*	6.34	205	10	5.19	193
Lung cancer	3	0.66	455	3*	0.53	566
Mesothelioma†	1*	0.02	5000	1*	0.02	5000
1944						
All causes	25	29.16	86	27	28.00	96
All cancers	7	6.71	104	17**	6.64	256
Lung cancer	1	0.65	154	1	0.64	156
Mesothelioma	2**	0.03	6667	6**	0.03	20 000

\*p < 0.05; \*\*p < 0.01.

†In addition, one cancer of the ovary in the one to four year exposures group was found on histological examination to be a mesothelioma of the peritoneum.