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# INTRODUCTION

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The two Asbestos Registers, The Disease Register and the Exposure Register have now entered their second decade, when established, certain aims were envisaged. They were:

1. to raise the awareness of asbestos related disease nationally
2. to improve the radiological diagnosis of asbestos disease by using the ILO reference radiographs
3. to confirm that pleural plaques is a disease and not just a marker for asbestos exposure
4. to reinforce the importance of patient support groups

To a large extent these aims have been achieved and the recent publications by Kjellstrom and by Smartt on asbestos related diseases, and the report in the Australian publication CCH OHS magazine June/July 2004 “Asbestos: A Ticking Time Bomb”, all support the correctness of the New Zealand Government’s initiative in 1990 to establish the Asbestos Advisory Committee which resulted in the Report of the Asbestos Advisory Committee to the Minister of Labour in April 1991 and the subsequent establishment of the National Asbestos Registers in March 1992.

While it is clear that the legacy of disease from working with and exposure to asbestos in New Zealand is continuing and will do so for several decades to come – it is predominantly a legacy from the past, with current exposure less and largely confined to brake repairers, lino removers, demolition workers, carpenters, electrical, plumbing and building maintenance workers and asbestos removal workers.

There are lessons to be learned from this world wide asbestos epidemic, and it is important to remember that high levels of asbestos exposure are still occurring in some parts of the world.

The first was that there was a general lack of awareness of the effects of inhaling dust at work – regardless of the type of dust – and in spite of the fact that historical evidence went back over 2000 years.

The second was that too great an emphasis was placed on arguing whether the dust was a danger to health or not. Concepts that cement dust was safe and silica dust unsafe or that blue asbestos was worse than white asbestos and so on, distracted governments from the real issue, namely dirty workplace air.

Today we recognise that dirty workplace air is a major problem in terms of respiratory and general health and that solutions are not complex. They involve the

putting in place of good general and local exhaust ventilation and providing comfortable and effective respiratory protection. While relatively simple technically, the motive force must be “the will to do it”.

Finally, the question must be asked of the Registers “where to from here?” It is clear that with the gradual reduction in cigarette smoking among the working population, the impact of dirty work place air on respiratory health will become clearer with diseases such as welders lung, asthma, chronic bronchitis and emphysema being recognised more clearly for their work relatedness.

It is thus time to consider expanding the Asbestos Registers to reflect the current situation in the workplace and to rename them the Occupational Respiratory Disease Registers.

Such a move would be in line with the growing recognition by government of the importance and seriousness of occupational disease, a recognition reflected in the recent report to the Associate Minister of Labour: “The Burden of Occupational Disease and Injury in New Zealand” by NOHSAC (the National Occupational Health and Safety Advisory Committee).

Dr W I Glass (Convenor)  
Dr R Armstrong  
Dr D Jones

National Asbestos Medical Panel

## *Part 1 Review of Registrations*

# SUMMARY

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This report reviews notifications made to the National Asbestos Medical Panel for the period March 1992 – November 2004. A total of 821 cases were reviewed, which included:

- 155 cases of mesothelioma
- 77 cases of lung cancer
- 191 cases of asbestosis
- 398 cases of pleural abnormalities

Once again it is noted that the number of lung cancer cases is relatively small compared with mesothelioma cases. This suggests that lung cancer history taking is dominated by the smoking factor and occupation is ignored.

The transfer of asbestos from the workplace to the home is another emerging feature of asbestos-related disease in New Zealand. Family members are presenting with pleural changes or, rarely and tragically, mesothelioma.

Mesothelioma notifications continue to rise, reflecting exposure in the 1960s and 1970s, and this trend is likely to continue for some years to come.

Three publications have arisen from the Registers.

They were:

- *Respiratory Symptoms and Asbestos Dust Exposure 1997*
- *Mesothelioma in New Zealand 2000*
- *Lung Function Changes in Asbestos Exposed Workers with Pleural Abnormalities 2000*

In addition special reports were published:

- *Recent Advances in Asbestos – Related Disease (Dr M Becklake) 1994*
- *The Epidemiology of Mesothelioma in Historical Context (Dr's JC and AD McDonald) 1998*

# RESULTS

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The following Figs. are based on the 821 cases reviewed over the period March 1992 to November 2004, and included

- 155 cases of mesothelioma,
- 77 cases of lung cancer,
- 191 cases of asbestosis, and
- 398 cases of pleural abnormalities.

## *Categories of Disease*

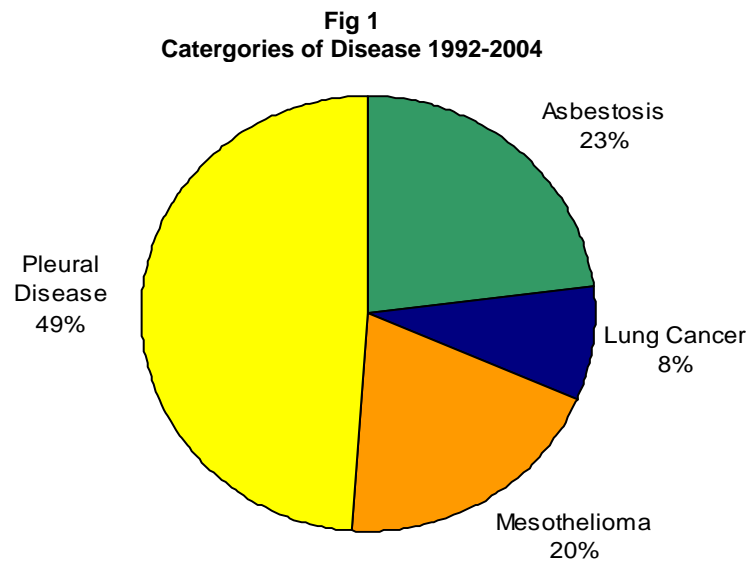


Fig 1 shows the distribution of the four main diagnostic categories: mesothelioma, lung cancer, asbestosis and pleural disease, what is noticeable is that pleural disease is the main category and lung cancer is clearly under represented when compared with mesothelioma.

# Occupation

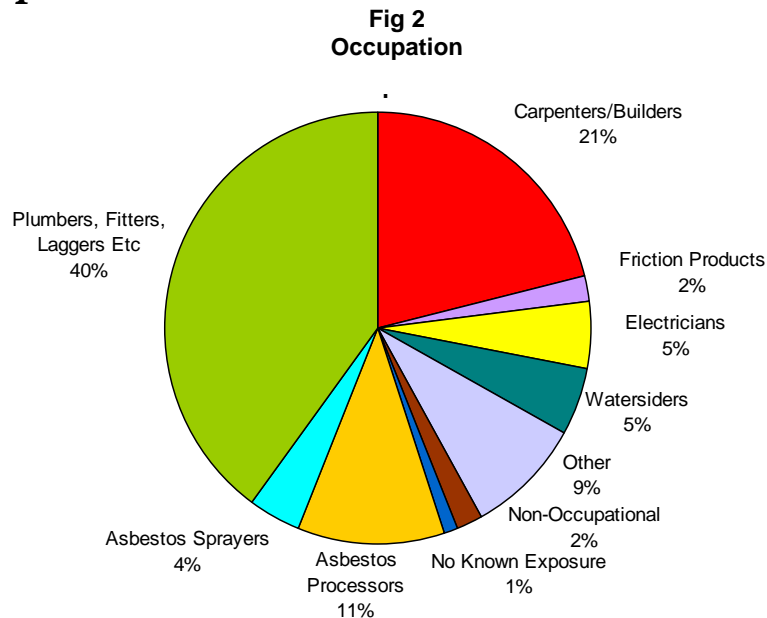


Fig 2 looks at occupation for the total number of notified asbestos disease cases. It is clear that carpenters, plumbers and electricians, etc. are together responsible for almost 66% of all cases. These “all purpose” construction workers are an occupational category at risk, and particularly so because, unlike asbestos-cement workers, they are not always seen as an obvious risk group.

The non-occupational category refers to cases where an individual’s exposure was not work-related. This includes all cases resulting from secondary or environmental exposure, such as children brought up in the home of an asbestos worker, and women who wash their husband’s asbestos-contaminated clothes. The “no known exposure” category refers predominantly to mesothelioma cases where conclusive exposure histories were not available.

## *Pleural Abnormalities*

This category includes pleural plaques, diffuse pleural thickening, chronic fibrosing pleuritis and pleural effusions. It does not include pleural disease occurring together with mesothelioma, lung cancer or asbestosis.

398 cases were reviewed.

387 were Caucasian,

7 Maori, and

4 Pacific Island.

All but 3 were males.

The mean exposure index was 177, with a range of 6 – 708.

There were 39 smokers, 244 ex-smokers and 104 never smokers. (Accurate smoking histories were not available in 11 cases.)

**Fig 3**  
**Occupations**

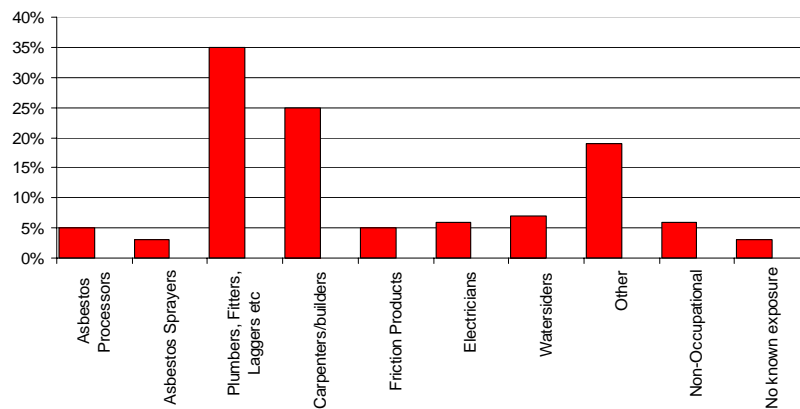


Fig 3 shows the distribution of pleural abnormalities according to occupation.

# Asbestosis

191 cases were reviewed, 189 were Caucasian and there was 1 Maori, and 1 Pacific Islander. Males numbered 176.

The mean age at diagnosis was 66 (range 37-86);

The mean number of years since first exposure was 39 (range 15-71).

The mean exposure index was 197 (range 10-720).

There were 17 current smokers, 138 ex-smokers and 30 never-smokers. (Accurate smoking histories were not available in 6 cases.)

Radiological changes showed 86 with pleural plaques, 13 with pleural thickening and 20 with both.

**Fig 4**  
**Occupations**

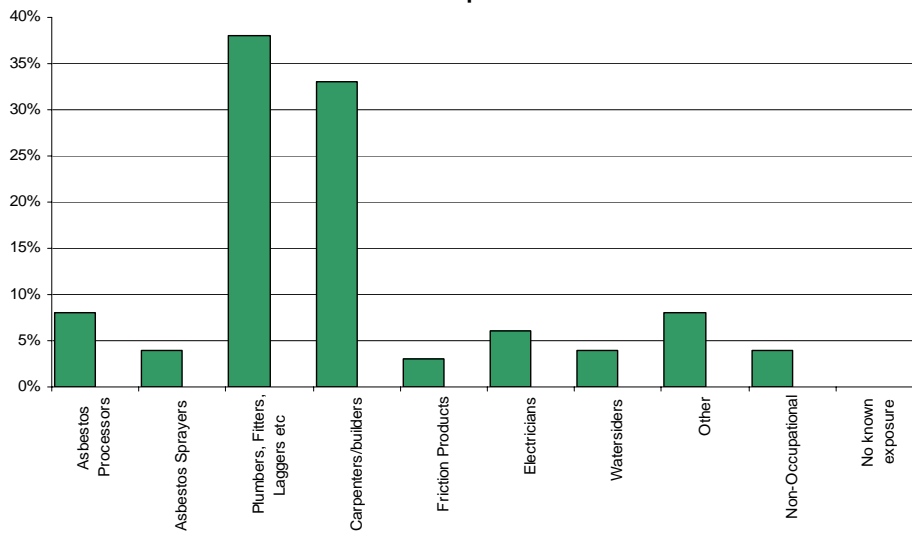
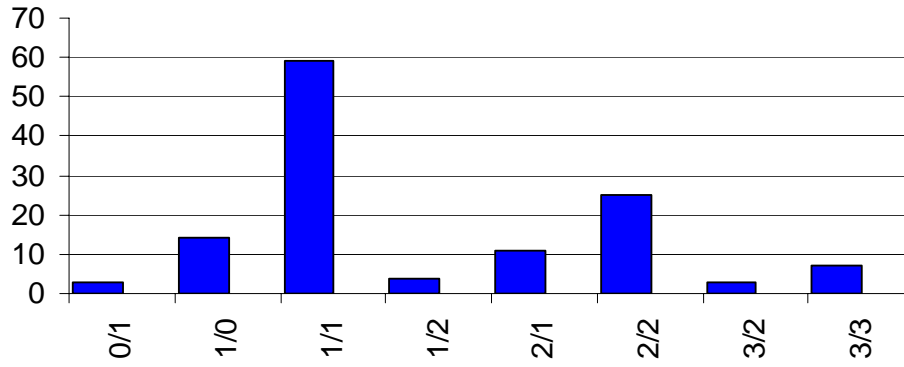


Fig 4 shows the distribution of pleural abnormalities according to occupation

**Fig 5**  
**ILO Grading of Asbestos Cases (n=143)**



Of the 191 asbestosis cases, 143 were categorised by ILO classification, others were categorised on the basis of CT, HRCT or pathology where available.

## *Definition of Asbestosis used in the Register*

An important issue with this disease is “What criteria constitute a diagnosis of asbestosis?”. The main point of discussion is the difference between a clinical diagnosis of asbestosis and a diagnosis suitable for use in a national database where the inclusion of patients with early disease is desirable.

Gilson defined asbestos along the following lines:

- Significant exposure to asbestos dust
- ILO Grade 1/0 or above
- Bilateral crepitations
- Restrictive Lung Function Pattern

The definition of JC Gilson in his review of asbestos-related lung conditions in the ILO encyclopaedia has been chosen by the panel for the reason stated above and is as follows.

- a) A history of significant exposure to asbestos dust rarely starting less than 10 years before examination;
- b) Radiological features consistent with basal fibrosis (1/0 and above, ILO 1980);
- c) Characteristic bilateral crepitations;
- d) Lung function changes consistent with at least some features of the restrictive syndrome.

**Gilson notes that not all criteria need to be met in all cases but that (a) is essential, (b) should be given greater weight than (c) or (d). However, occasionally (c) may be the sole sign. Further he notes that although the restrictive syndrome is the commonest pattern (about 40%), in about 10% of cases airway obstruction is the main feature and in the remainder a mixed pattern is seen.**

In the 191 asbestosis cases:

- All had a significant exposure history with a mean exposure index of 197 (range 10-720).
- Mean latency was 39 years, with a range of 15-71 years.
- All cases except one were classified as ILO 1/0 or greater by the panel’s radiological consultant. (The majority being 1/1 or greater.)

- Detailed clinical examination results were not always available from the records, thus the presence of crackles was not measurable.
- Lung function changes are recorded in the Register based on the availability of data either from respiratory laboratories, respiratory physicians, or occupational health nurses.
- Additional information from HRCT Scanning has led to the recognition of some cases of asbestosis not covered by the Gilson criteria.

The numbers in our report are small but confirm that the classical restrictive picture does not dominate, with obstructive, mixed, and normal patterns all occurring.

# Lung Cancer

77 cases were reviewed, 72 being Caucasian, 3 Maori, 1 Pacific Islander, and 1 other. 75 were males, 2 females.

- The mean age at diagnosis was 64 (range 42-80)
- The mean number of years since first exposure was 40 (range 17-62)
- The mean exposure index was 156 (range 12-565).
- There were 15 current smokers, 54 ex-smokers, 5 never-smokers and 3 unknown.

Background radiological changes showed 5 with lung parenchymal changes, 16 with pleural plaques alone, 4 with diffuse pleural thickening alone and 4 with pleural plaques and thickening.

Histological classification revealed 37 squamous cell, 22 adeno, 10 oat cell, 4 undifferentiated, 1 bronchiolar-alveolar, 2 large cell, 1 not stated.

Tumour site was as follows: 38 upper lobe (24 squamous, 7 adeno, 3 oat, 1 large cell and 3 undifferentiated), 26 lower lobe (10 squamous, 14 adeno, 2 oat), 6 middle lobe (all squamous), and 7 not stated.

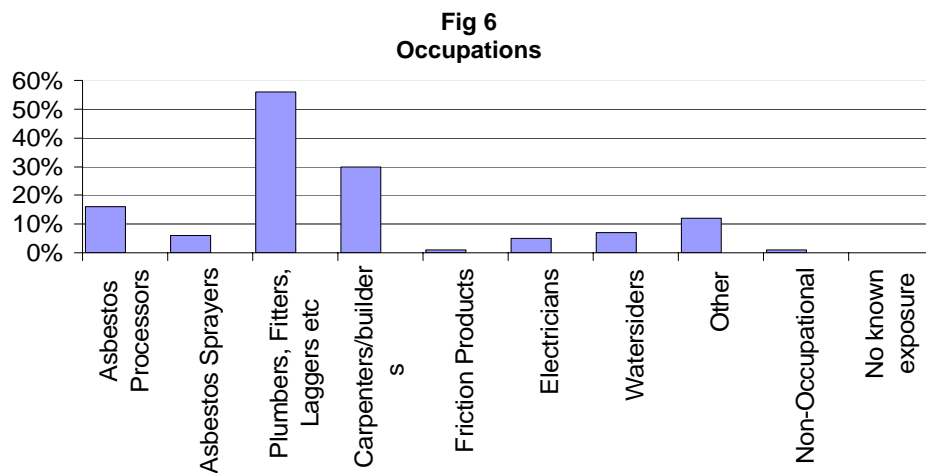


Fig 6 shows the distribution of lung cancer by occupation

# Mesothelioma

155 cases were reviewed, 147 being Caucasian, 5 Maori and 3 other. 145 males and 10 females.

- The mean age at diagnosis was 63 years (range 35-89).
- The mean number of years since first exposure was 42 (range 12-74).
- The mean exposure index was 200 (range 1-780).
- There were 16 current smokers, 87 ex-smokers and 39 never-smokers (information was not available for 13 cases).

The three categories: Asbestos processors, plumbers/fitters/laggers, and carpenters/builders, comprised 64% of all registered cases.

It has been noted that an asbestos exposure history may be lacking with mesothelioma cases. Our experience suggests that with patience and a recognition of the range of likely exposures, it is often possible to obtain evidence of asbestos exposure. In one case the disease developed in a middle-aged woman living in a small rural town. It was revealed that as a teenage girl she had washed the clothes of her older brother who was an apprentice in a railway workshop. Asbestos lagging was used in the repair and maintenance of the boilers, and apprentices frequently had “snowball fights” with the asbestos.

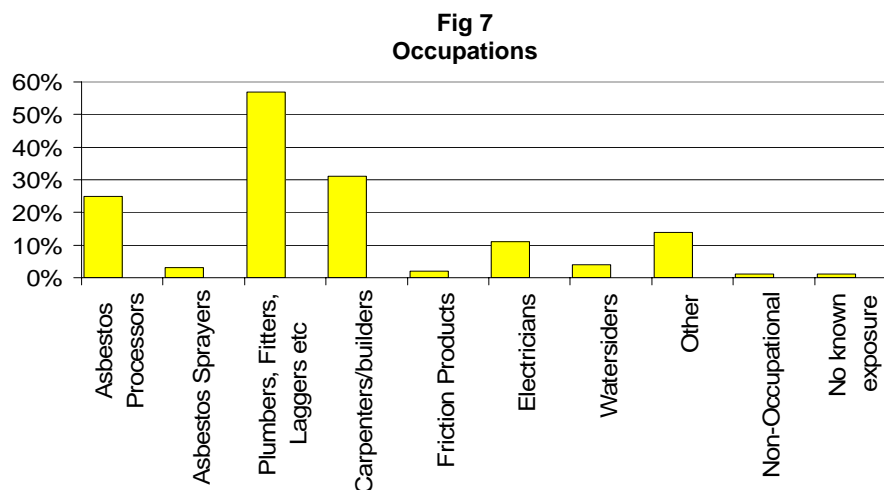


Fig 7 shows the distribution of mesothelioma by occupation

## *Discussion*

It is recognised that the information recorded in the Disease Register underestimates the total burden of asbestos related disease in New Zealand. This is a consequence of the voluntary nature of the Register, the lack of understanding of work as a factor in disease causation by the medical profession and the failure of the Cancer Registry to code occupation in their data base. Nevertheless the Disease Register has served a useful purpose. There is a greater awareness of work as a factor in disease compared with 1992 when the Registers began. OSH has a greater commitment to the importance of occupational health, ACC employs a greater number of occupational doctors, and there is an increasing number of occupational nurses and safety officers working in the private sector. While it would be unreal to see these developments as directly arising from the activities of the Asbestos Registers, the Registers as part of the wider NODS scheme operated by OSH have in the view of the medical panel played an important part in encouraging these developments.

### **Pleural Plaques**

One of the aims of the medical panel was to confirm the view that pleural plaques were not just a marker of exposure but represented a disease state. The publication, Lung Function Changes in Asbestos Exposed Workers with Pleural Abnormalities, in 2000, indicated a clear dose response pattern with a reduction of FVC and FEV1 with increasing asbestos exposure and independent of smoking habit.

### **Asbestos**

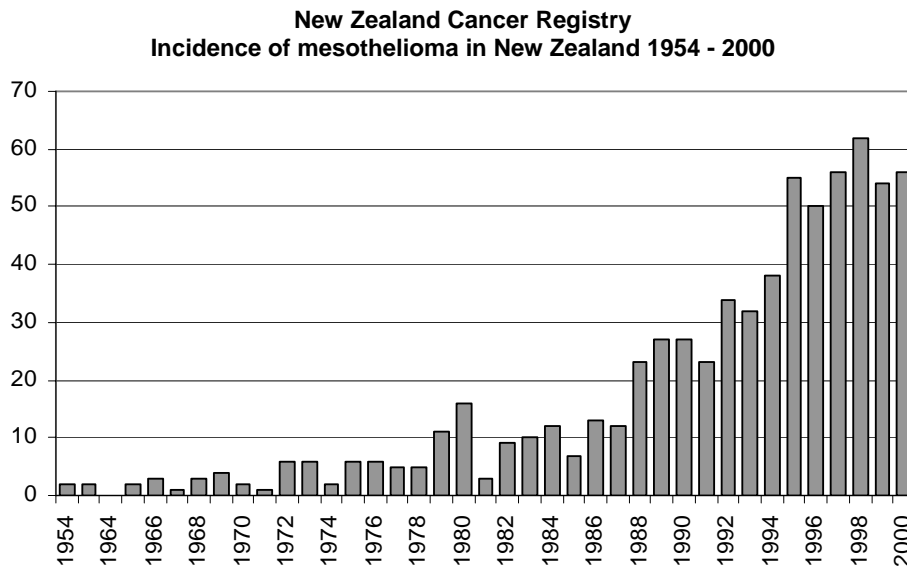
The increasing use of HRCT has resulted in the identification of minor degrees of asbestosis often with few if any symptoms and no disability. It is possible that these individuals will have a better long term outlook although this is not yet established.

### **Lung Cancer**

The contribution of occupational asbestos exposure to the causation of lung cancer is well recognised as being underestimated and incorrectly attributed to smoking. One approach to this issue is to determine a ratio between mesothelioma and lung cancer on the grounds that most mesotheliomas are diagnosed and the majority are seen as caused by asbestos exposure at work. Kjellstrom in a recent paper on this issue noted that estimates can range from between 1 and 10 in other countries with the most likely ratio being 2. Thus one can postulate that a much higher number of asbestos caused lung cancers are occurring than is currently being recorded in the Register or as pointed out by Kjellstrom, being accepted by the ACC.

## Mesothelioma

Reported cases of mesothelioma have accelerated in New Zealand over the past decade as illustrated in the graph below. Unfortunately to date treatment of this rapidly fatal disease is unsatisfactory.



## Conclusion

Asbestos related occupational disease continues to disable and kill workers in New Zealand. The extent to which this is occurring can only be estimated but it could be in the vicinity of 200 or more each year. When this disease is put into perspective as part only of the total burden of occupational respiratory disease due to work it is clear that a major task lies ahead to clean up dirty workplace air. With the ban of smoking in the workplace the true extent of non-smoking related occupational respiratory disease will become increasingly apparent.

## Recommendations

1. The panel is of the view that the time is appropriate for extension of its functions to include all occupational respiratory disease.
2. The panel recommends that OSH should take the initiative to provide general practitioners with a useful guide to recognising the work factor in illness.
3. The panel is of the view that teaching of the work factor in illness should be integrated into the teaching of clinical medicine generally in the medical schools in New Zealand.

## *Part 2 Background to the Registers*

# BACKGROUND TO THE REGISTERS

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The National Asbestos Registers were established in March 1992 in line with the recommendations made to the Minister of Labour by the Asbestos Advisory Committee.

## *Formation of the Asbestos Advisory Committee*

The Asbestos Advisory Committee was established in October 1990 as an ad hoc body to report to the Minister of Labour on issues relating to the health effects and use of asbestos in New Zealand, adequacy of controls and legislation, and clarification of the legal entitlements available for affected workers. This followed increasing public concern about the past and present effects of asbestos on workers, former workers and their families.

## *Establishment of the National Asbestos Registers*

Recommendation 4 of the Report of the Asbestos Advisory Committee to the Minister of Labour advised:

*That an asbestos medical register be established for people who have been significantly exposed to asbestos. OSH should be the organisation responsible for establishing, maintaining and funding the medical register.*

*The medical register should be in two parts:*

*Part 1 – Those notified as having been exposed to asbestos;*

*Part 2 – Those notified as having an asbestos-related disease.*

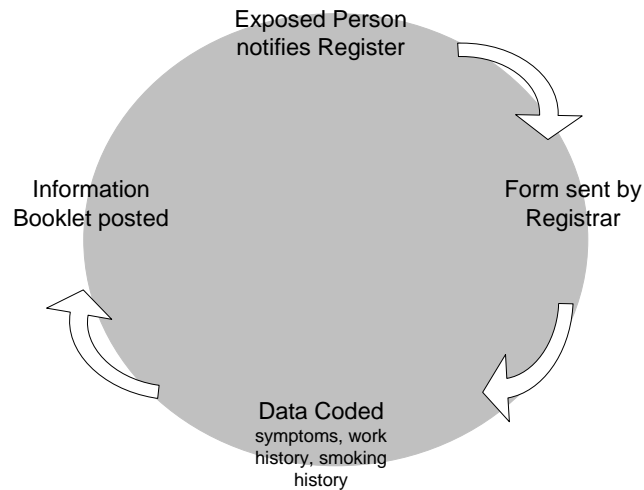
*The system should allow movement of the name of a registered person from part 1 to part 2 of the register when indicated.*

*Notifications to part 1 of the medical register were to be made by those who felt that they had been exposed to asbestos, or by people acting on their behalf (and following consultation) such as an employer, union official, relative or friend.*

*Notification to part 2 of the medical register would be done by medical practitioners.*

A Notifiable Occupation Disease System (NODS) was established in 1992 and asbestos registers have been incorporated in that scheme. This was in accordance with recommendation 5 of the Asbestos Advisory Committee.

# *Asbestos Exposure Register*



The Occupational Safety and Health Service of the Department of Labour (OSH), in association with the Electricorp Production, undertook an extensive advertising campaign in March and April 1992. Advertisements were published in all of the major newspapers, and several trade magazines.

The interest generated as a result of this campaign has ensured a high response rate for the exposure register. Notifications have been made by individuals, trade unions, occupational health nurses, doctors, the Asbestos Diseases Association of New Zealand and by some larger companies.

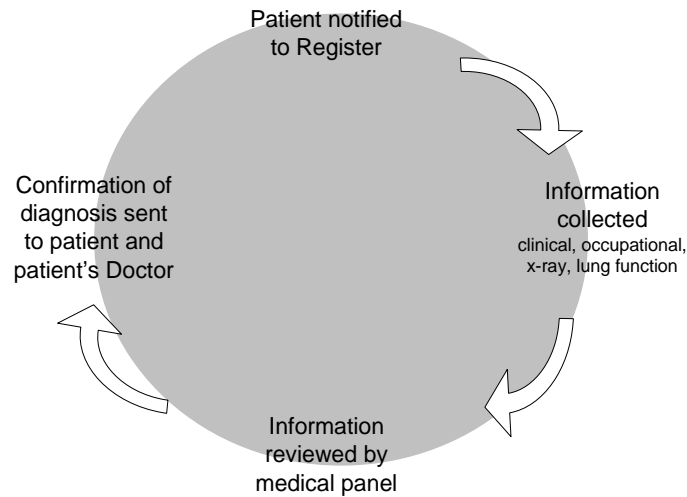
Notifications are directed to branch offices of OSH or directly to the Registrar.

In recommendation 4, the committee had envisaged that people wishing to be recorded on the asbestos exposure register would have their exposure assessed at an OSH branch. Only those people who were judged as having had “significant exposure” would then be recorded on this register. However, the huge response from those individuals who had been exposed made it impractical to screen registrants in this fashion.

Once a person has notified OSH that they have been exposed to asbestos, an asbestos exposure registration form is sent. The registration form collects information about the individual, their work exposure to asbestos and the state of their respiratory health.

When the form has been completed and returned to the Registrar the details are recorded on a database. The individual is then sent a copy of a special publication, *Asbestos - A Deadly Dust*, which is dedicated to asbestos and its associated health problems. If the person indicates that they have a family doctor, the doctor is informed that their patient has been included on the Asbestos Exposure Register, and is sent a copy of OSH's booklet *Asbestos Exposure and Disease: Notes for Medical Practitioners*.

# *Asbestos Disease Register*



Tenders for the National Asbestos Medical Panel were called for in 1991. A tender was accepted on 31 October 1991. The successful tender came from the group listed below:

Dr R Armstrong, Professor R Beasley, Dr J Crane, Associate Professor W Glass, Dr D Jones, Dr N Pearce

Dr Beasley retired upon his appointment as Professor of Medicine at the Wellington Clinical School. Dr Crane joined the national Occupational Asthma Panel. Dr D Fishwick joined the panel in 1997. He was subsequently appointed to a position in the United Kingdom.

The first meeting of the panel was held in February 1992.

Associate Professor Glass was nominated as the panel's convenor.

The following members were appointed to the National Asbestos Radiological Panel:

Dr Paul White, Dr George Foote, Dr Graeme Anderson

The Registrar from 1991 to 1996 was Mr Craig Eades. From 1996 to 1998 the position was held by Ms Nicola Holden, and later in the year by Ms Andrea Eng until 1999 when Ms Louisa Thomas was appointed. In 2002 Ms Jenny West was the Registrar with Mr Dougal McNeill Registrar in 2004.

### **Processes for Registering People**

Notifications for the register came from two major sources. The first from doctors whose patients had been diagnosed, or were suspected of having, an asbestos-related disease. The second source of notification was from the individuals themselves.

Once a notification was made to the Registrar, and consent has been gained from the person concerned, relevant medical records and a full occupational history were obtained.

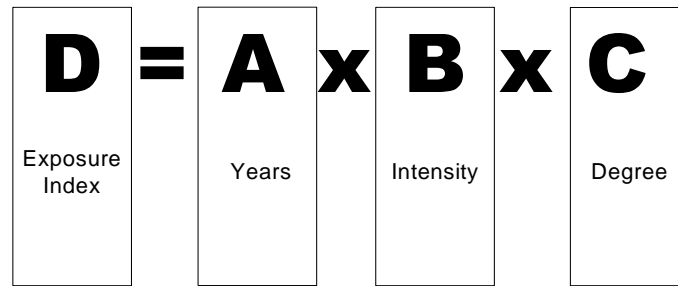
### **Data Collection**

The data collected included a medical history, an occupational history, chest x-ray, CT scan where available, lung function tests, and pathology reports. The procedure was as follows:

On notification being received by the Registrar:

- a) An occupational health nurse would visit the patient and carry out a health interview, a detailed occupational and social (including smoking) history.
- b) Relevant medical reports were obtained from general practitioners and physicians.
- c) A recent PA chest x-ray was obtained, and in all cases was read by a radiologist according to ILO (1980) guidelines. CTs were used where available, and on occasions requested.
- d) Lung function data was obtained from physicians' reports or requested from respiratory laboratories. Where this was not possible, results were obtained from a test carried out by an occupational health nurse, using a portable spirometer.
- e) Pathology and post mortem reports were reviewed where available.

# *Exposure Index*



**This is calculated for each job and total exposure is the sum of each D.**

## **Data assessment**

The National Asbestos Medical Panel reviewed the information obtained, calculated an exposure index (see below) and correlated the medical data.

## *Exposure index*

An exposure index (D) was calculated from the product of *years* of asbestos exposure (A); *intensity* of exposure, using a 1-5 grading according to job category (B); and *degree* of exposure, using a 3 point grading (C).

Guidelines for calculating this index are shown below.

**A = Total years of exposure** in any one job

**B = Job intensity** as follows

Mining, milling and processing = 5

Boiler/lagging, rail carriages, shipyard, spraying insulation = 4

Asbestos cement products, construction, demolition, removal = 3

Electrical, friction products = 2

Loading, driving, environmental = 1

**C = Degree of exposure (unprotected)**

Continuous (>50% of work) = 5

Intermittent (20-50% of work) = 2

Minimal (<20% or occasional) = 1

**D = A x B x C for each job**

**Exposure index = sum of all Ds**

**Medical data**

Relevant respiratory symptoms and signs were recorded from the medical histories, and lung function data was classified into restrictive, obstructive, mixed or normal. Pathology reports were used to confirm mesotheliomas and classify lung cancers.

**Classification of diagnostic categories**

On the basis of the foregoing, the cases were placed into a primary diagnostic category of:

- Mesothelioma
- Lung cancer
- Asbestosis
- Pleural abnormalities (plaques, diffuse bilateral pleural thickening and effusions).
- Other cancers
- Obstructive lung disease without x-ray changes.

*Part 3    Spiral CT Scanning and Lung Cancer  
Screening*

# SPIRAL CT SCANNING AND LUNG CANCER SCREENING

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A consensus report on behalf of the National Asbestos Medical Panel Dr P White and Professor N Pearce 2003, following a Department of Labour. Meeting of interested parties to discuss this issue, 2002-2003.

## *Spiral CT Scanning*

CT scanning (computerized tomography), also known as CAT scanning, is a computerized x-ray examination. It has become an essential medical investigative tool over the past 25 years. CT was developed in the United Kingdom in 1972 and its inventors were awarded the Nobel Prize. It has revolutionized radiology and medicine as it allows the inside of the human body to be viewed with a clarity never before possible. For example, structures tinier than the head of a pin can be seen within the lung.

The patient being scanned lies on a sliding table which moves slowly through a ring or doughnut-shaped gantry. Encased within the gantry, an x-ray tube rotates around the patient's body sending x-rays through the body as it turns. The x-rays are then detected by numerous sensors arranged in a circle around the patient. The information collected from multiple points within the patient's body is sent to a computer which combines all the information to create a cross sectional image of the body. The image can be viewed on TV or printed onto film.

Each individual CT image corresponds to a thin cross-section of the body. The anatomical detail obtained by CT is of a high quality and by viewing several adjacent images the computer can provide the radiologist with a clear three-dimensional view of the body's internal architecture.

Whereas conventional CT collects data intermittently as each individual level in a region is scanned, spiral CT collects data continuously as the patient's body slides slowly through the x-ray gantry. The data collected by spiral CT is thus more comprehensive and can be reprocessed by the computer to give thinner images and a more detailed view. Superb 3D reconstructions, as well as images in other cross-sectional planes can be produced by the computer from the original data to improve diagnosis. Spiral CT scans can be performed more rapidly than conventional CT, which is important if the patient is uncomfortable or restless.

The procedure is safe, painless and cost effective and has become the accepted standard technique for the investigation of chest diseases as well as other medical problems.

# *Lung Cancer Screening Trials Comparing CT with Chest X-rays*

Recent rapid technological advancement has prompted several trials of low-dose spiral CT in the early detection of lung cancer. Three of these trials have entailed the combination of both chest x-rays (CXR) and CT.

The first two trials initiated were nonrandomized screening studies from Japan. Both used a combination of CXR's and CT; one was performed on smokers and the other on both smokers and nonsmokers (1,2), 6,341 patients in one and 1,369 patients in the other. The third such trial (Early Lung Cancer Action Project or ELCAP) took place in the United States (3) and enrolled 1000 "highrisk" patients (smokers over 60 years), in a non randomized trial with low dose CT and CXR's.

There is another large ongoing US Trial, the Mayo Lung Trial in which 1,520 smokers over 50 have been screened with annual low-dose spiral CT and sputum cytology (4). CXR's were not performed as previous data was accepted as having established the superiority of CT over CXR for early lung cancer detection. Prevalence-screening data from all these trials confirms the well-accepted and previously published premise that CT is more sensitive than conventional CXR for the detection of lung nodules and that some of these nodules represent lung cancer.

## *Comparison Data: CT vs CXR*

1. Sone S et al  
6,341 patients, all smokers  
Mean cancer detection rate for CT: 0.36%  
Mean cancer detection rate for CXR: 0.03 - 0.05%  
Spiral CT mean detection rate for lung cancer 10 times greater than for CXR  
CXR negative for 63% of the cancers detected by spiral CT
2. Kaneko M et al  
1,369 patients, non smokers and smokers  
Mean cancer detection rate for CT: 0.43% (15 cases)  
Mean cancer detection rate for CXR's: 0.12% (4 cases)  
Average diameter of tumour detected on CT: 16mm  
Average diameter of tumour detected on CXR: 30mm

3. Henschke CI et al (ELCAP)  
1000 patients, all smokers  
Patients with nodules detected on CT: 233  
Patients with nodules detected on CXR: 33  
False positive cases on CXR: 35 (false nodules due to superimposed shadows on CXR)  
Cancers detected on CT: 27  
Cancers detected on CXR: 7  
Stage 1. (small) cancers detected on CT: 23  
Stage 1 cancers detected on CXR:4

A comparison of data between the recent prevalence trials and prior screening trials in the 1970's reveals that there will be more lung cancers found (27 per 1,000 vs 7.6 - 9.1 per 1000) and that more patients will have resectable early stage disease at CT screening compared to CXR screening. (5). The clinical importance of some of these "additional" small tumours now detected on CT screening remains uncertain.

## *Does Early Detection Influence Outcome?*

Worldwide interest in screening for early lung cancer detection was sparked in the early 1970's when the US government declared "war" on cancer and provided funding for several large clinical trials of screening.

Four randomized clinical trials of lung cancer screening were undertaken, (6-11) three of which were sponsored by the US National Cancer Institute, and another trial was performed in Czechoslovakia. All three American trials, known as the Johns Hopkins, Memorial Sloan-Kettering and Mayo Lung Projects, utilized chest x-rays (CXR) and sputum cytology every 4 months and compared that with either CXR alone or no screening. The Czechoslovakia trial compared screening with CXR alone and no screening at all. These four randomized clinical trials combined, enrolled approximately 37,000 "high risk" male smokers over the age of 45 years.

In each of these trials investigators found an increased incidence of earlier stage lung cancers, more resectable (operable) cancers and improved 5 years survival rates (35% vs 15%) in the groups screened with CT compare with the comparison groups (12). However, none of these trials demonstrated a statistically significant decrease in lung cancer mortality. In other words more patients were diagnosed with lung cancer and more were apparently cured in the screened groups than in the control groups, but ultimately, equal numbers of patients in the two groups died of the disease.

Most if not all of the discrepancy between improved survival on the one hand and mortality on the other was explicable on the biases introduced by screening, namely lead-time bias (the timing of diagnosis), length-time bias (differing rates of disease progression) and the over diagnosis bias (diagnosing cancers which do not cause symptoms or death).

A recent re-analysis and follow-up of one of the large American trials (13) showed slight excess (not significant) in both lung cancer and non lung cancer deaths in the screened group, suggesting that there were fatal complications of treatment that were unrecognized.

The undoubted potential benefits of screening to a few of the screened subjects must outweigh the potential harm of the screening process to the whole of the screened group. Factors to be considered are the radiation dose (the equivalent of 6 months background radiation in NZ) (14), investigation and intervention of false positives, associated anxiety and stress, inconvenience and cost. There is no doubt that low dose spiral CT will detect more lung cancers at an earlier treatable stage than CXRs did. Whether that will result in any improvement in outcome remains to be seen. Research continues. Screening for lung cancer is a complex and controversial subject. It has yet to be shown if earlier detection by spiral CT will result in reduced mortality.

## *Should Asbestos-Exposed Workers Be Screened For Lung Cancer?*

This question arises inevitably from the issues discussed concerning spiral CT. The purpose of screening is to detect a disease process at a stage where it can be reversed, arrested or at the very least slowed.

Tests used for screening must be available at a reasonable cost, safe and acceptable to the individual. Such tests must be able to be carried out with accuracy, consistency and be reproducible. Finally they must be sensitive, specific and have a positive predictive value.

A meeting in Helsinki, January 1997 (15), comprising 19 experts from 8 countries which do not produce asbestos, considered new developments in asbestos disease detection and in particular the impact of spiral CT on earlier detection.

The conclusions of the meeting were:

At this stage spiral CT is not recommended for screening of the general population for lung cancer.

Spiral CT has great potential for screening well defined high risk groups such as asbestos exposed workers.

There is an urgent need to include one or more defined cohorts of asbestos-exposed workers in ongoing research investigating the usefulness of spiral CT.

An international classification scheme should be established for pulmonary and pleural abnormalities for reading CT scans of persons with a history of occupational asbestos exposure.

### *Recommendation*

At the present state of knowledge of Spiral CT scanning it is not recommended that screening by this method of asbestos exposed workers should be undertaken.

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## *Part 4 What is Asbestos*

# WHAT IS ASBESTOS?

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Asbestos is a term used to describe naturally occurring fibrous hydrated silicates of which there are six common varieties. The figure below shows the different types of asbestos:

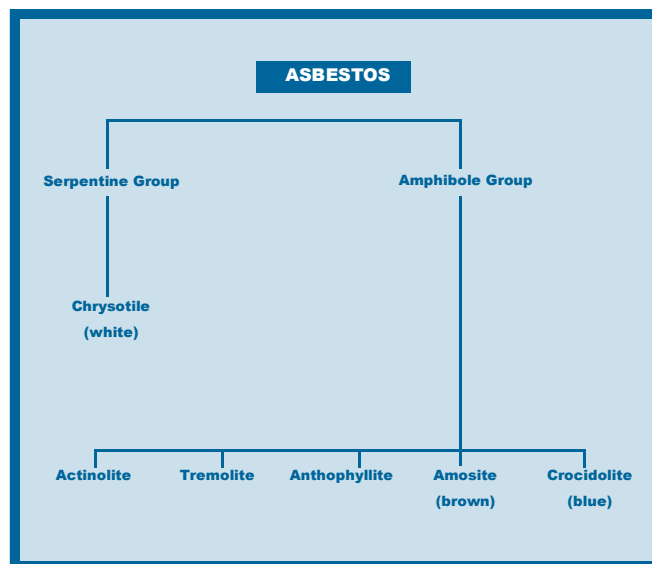
Amosite (brown asbestos) and crocidolite (blue asbestos) have straight needle-like fibres which naturally split in their long axis producing very fine fibrils (thin fibres). In contrast chrysotile, (white asbestos) has softer curlier hair like fibres, which make them useful for weaving and have been used to make asbestos cloth for centuries.

When these fibres are inhaled they behave in different ways in the lungs.

Chrysotile (magnesium silicate) fibres slowly lose magnesium, which leaches out in the body fluids making the fibre more easily digested by scavenger cells (macrophages). This reduces the body burden of the asbestos dust and has led to the view that white fibres are less harmful.

Crocidolite (iron-sodium silicate) fibres are straight and rigid, can split longitudinally, are more resistant to body fluids so that they survive unchanged in the body for up to 40 years or more, and the fine fibrils can migrate through the lung tissue to the lung lining (pleura).

Amosite (iron magnesium silicate) fibres are longer making it useful for insulation and again the fibres remain unchanged in the body for years.



# THE USES OF ASBESTOS

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The word asbestos was first coined by the Romans in the first century AD, but by that stage the material had already been in use for at least 2000 years. Archaeological evidence from Finland has shown that a type of asbestos was used to strengthen clay pots over 4000 years ago. The Roman writer Plutarch described in the first century AD a cloth woven from asbestos fibres that could be cleaned by immersion in fire, and when the Venetian explorer Marco Polo returned from the East 1200 years later he too described a fire suit he had seen there.

However, it was not until the late nineteenth century that asbestos began to be used on a large scale in the manufacture of many different items. From the 1880's it was used increasingly in the textile industry to produce incombustible products, also gland packings and other linings for machinery. The different types of asbestos had some remarkable properties – with their resistance to heat, friction and chemical decomposition combined with their fibrous nature; and as the industrial age – particularly the development of the automobile – gathered momentum early this century, asbestos began to be used in an increasing range of applications. World War I saw asbestos being used as thermal insulation in naval vessels and by the 1920's the substance was firmly established as a vital ingredient in the manufacture of friction clutches and brake linings.

Coinciding with this increased use was the discovery of large reserves of white and blue asbestos in Russia, Canada and South Africa. Reserves of both were also found in Australia. Asbestos became popular as the reinforcing material in asbestos cement products, including wall claddings and roofing materials, pipes and other building materials. At the same time it was used more and more in its raw state as an insulation material in buildings, around boilers, and as a fire retardant around structural steelwork.

The post-war years were the heyday of asbestos use in New Zealand and around the world. Each of the three main types of asbestos – white, blue and brown – were sprayed, and spread in what seemed to be an ever increasing range of applications throughout industry, as part of machinery components, and, to a lesser extent, in homes. A United Kingdom report in the late 1970's estimated that about 3,000 manufactured products contained asbestos in one form or another. The same report said there were over 21,000 people in the United Kingdom alone employed in the manufacturing of products which contained some degree of asbestos, and about the same number employed in processes which were subject to the asbestos regulations of the time.

# ASBESTOS USE IN NEW ZEALAND

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Until just before the Second World War asbestos really only found its way into New Zealand in the form of manufactured items. Since that time, the only asbestos-containing products that have been manufactured in any quantity in this country were asbestos cement building materials, such as roofing and wall claddings, pipes and other moulded products.

There have been two plants producing asbestos cement products. The first was established in 1938 at Penrose in Auckland, by the Australian company James Hardie Ltd. A second factory, operated by the local company Fletcher's, was established in the Christchurch suburb of Riccarton in 1943. Depending on the item being manufactured, they were made of a mixture of Portland cement, sand, and usually between 5 and 15 percent of either chrysotile, amosite or crocidolite —the asbestos acting as reinforcing because of its fibrous nature and its high tensile strength. The types of asbestos used varied. The bulk was the white variety, chrysotile, which was cheaper and more easily worked. Because the “best” blue crocidolite from South Africa was more expensive, it tended to be used only in products requiring greater heat tolerance or strength (such as in pipes expected to contain higher pressures or temperatures). A lesser quality crocidolite from the Wittenoom mine in Western Australia was also used to some extent. Amosite, or brown asbestos was imported from Rhodesia (now Zimbabwe) and was only ever used in small quantities.

The Auckland plant produced asbestos cement products until 1987 although from 1983 asbestos had been phased out of sheet products and included only in pipes. At peak production in the mid 1970's the Penrose plant employed up to 600 employees at any one time.

The Christchurch plant, called Durock Industries, operated until 1974. Estimates of the numbers employed over the life of the factory vary between 900 and 2000 – and are confused by the fact that large numbers of casual workers were employed.

Another major use of asbestos was as the raw material for insulation products. This saw the various types of asbestos mixed with a binder and sprayed around boilers, pipes, ducts and other places where insulation against heat, or sometimes noise was needed. From the 1950's until the 1970's thousands of tonnes of asbestos were applied in this way, most notably in the power stations built in the period, but also in railway workshops, shipbuilding and maintenance and other large-scale industrial applications. Sprayed asbestos was also used extensively as a fire retardant for protecting structural steelwork. Usually the insulation material was applied by

contractors who mixed asbestos from the bags or sacks it had been imported in, before spraying the mixture on to chickenwire reinforcing.

Other workplaces where asbestos was used included railway workshops boiler rooms, and in fact most of the country's major industrial complexes where insulation against heat was required. Some of the industrial applications were less obvious. For example, asbestos was commonly used in the brewing industry to filter beer from the 1920's until the early 1970's, and it was dropped into wine to act as finings and clarify the finished product. Another unusual use for blue asbestos was as a filtering component in gas masks of British manufacture that were standard issue for troops and others from the first World War until after the Second World War. An inner core of asbestos was surrounded by woollen wadding, and the item was standard issue to all New Zealand troops in danger of gas attack.

Before the Second World War, asbestos was not imported in its raw state in sufficient quantities to appear in the import statistics. With the beginnings of local manufacturing and the increase in post-war construction, more than 2,000 tonnes were being imported annually by the late 1940's. This continued throughout the 1950's with peaks of up to 5,000 tonnes in some years. Usage increased dramatically during the 1960's and until well into the 1970's with 5,000 tonnes being a minimum amount that was imported through those years, and the average being closer to 8,000 tonnes. Imported asbestos peaked in 1975 at 12,500 tonnes, although as recently as 1983, 3,000 tonnes were imported.

Throughout the 40 years asbestos was imported in large quantities, about two-thirds of the amount imported was chrysotile from Canada, with the balance being made up of different types from Australia, South Africa or, to a lesser extent, the United States.

Asbestos was only ever mined in small quantities locally, as chrysotile from a single mine near Takaka from the early 1950's until the early 1960's. It was of a low quality and had to be mixed with the imported material. In the late 1960's sizable deposits were surveyed near Dusky Sound, but for various reasons these were never exploited. Since 1984 the importing of blue and brown asbestos has been banned.

# KEY DATES IN THE HEALTH HISTORY OF ASBESTOS

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- 1898** Adelaide Anderson, DBE, MA, Principal Lady Inspector of Factories in the Home Office, noted that asbestos fibre inhalation in the workplace was injurious to the bronchial tubes and lungs. Referring to complaints from girls employed from 1898 onwards, she wrote: "The sharp jagged edge of the insoluble mineral dust has undoubtedly occasioned much illness and death from respiratory disease."
- 1906** Dr Montague Murray recorded fibrosis of the lungs in a 33 year old asbestos cloth worker. He had been employed ten years and was the sole survivor of ten men who were at work in the carding room when he began his employment.
- 1924** Cooke coined the term asbestosis.
- 1928** Merewether and Price launched an extensive investigation into the disease and in 1930 published their results.
- 1931** Great Britain introduced Asbestos Industry Regulations.
- 1955** Doll confirmed the relationship between lung cancer and asbestos exposure.
- 1960** Wagner reported pleural mesothelioma among asbestos miners.

# ASBESTOS AWARENESS IN NEW ZEALAND

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**1938** The introduction to the *Report of the Interdepartmental Committee on Silicosis* refers to asbestos as follows:

“In the working of asbestos the dust produced gives rise to a pulmonary condition known as asbestosis, which, although different in its character from silicosis, causes a disease similar in some respects to it. Free silica is not associated with asbestos, yet the fibres produce a deadly pulmonary disease.”

**1951** In the *Annual Report of the Department of Health* Dr Garland, Director of the Division of Occupational Health notes:

“Asbestos is now being quarried in the Dominion, and the dust can be expected to cause a certain amount of lung damage unless proper precautions are taken.”

**1953** Notification of occupational diseases introduced. No specific identification of asbestos related lung disease.

**1960** Occupational Health Notes on Diseases Arising from Occupation published by the Department of Health:

“The fibrosis of asbestos is diffuse... there is some statistical evidence for

an increased incidence of bronchogenic carcinoma.”

**1964** A New Zealand standard is set for asbestos fibres in air.

**1968** Dr Copplestone, Assistant Director (Occupational health) initiates a New Zealand asbestos survey.

**1971** Dr Allingham, who succeeded Dr Copplestone, reports on survey:

207 workers surveyed.

101 workers x-rayed.

17 showed pleural changes (one case later confirmed as asbestosis).

**1977** Environmental Dust Laboratory established for the identification of asbestos fibres in air.

**1978** Asbestos Regulations promulgated.

**1981** The allowable concentration for asbestos fibres (other than crocidilite fibres) was reduced from 2 fibres/ml to 1 fibre/ml. Crocidilite remained at 0.2 fibres/ml over a 10 minute sampling period.

**1982** Jim Butterworth, Auckland Secretary, NZ Engineers Union

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## ASBESTOS AWARENESS IN NEW ZEALAND (CONT)

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expresses, concern about long term effects of asbestos on workers at James Hardies factory.

**1983** *Interim Report of Workers at James Hardies* (unpublished). Kjellstrom T. and Rennie F.

Of 353 workers x-rayed. 53 showed parenchymal and/or pleural changes.

An increasing percentage of abnormalities found over time since first exposure.

**1983** Asbestos Regulations replace 1978 regulations.

**1983** Gazette notice reduced air standard for crocidolite to 0.1 fibre/ml over 4 hours

**1984** "Relative Cancer Risks from exposure to Different Asbestos Fibre Types." J.Keir Howard, *NZ Medical Journal 97*" 646-9. In this review article, the point is made that: ".....considerable amounts of crocidolite were used in the past particularly in insulation and as New Zealand did not restrict the use of the amphiboles until well after most industrialised nations had done so, the use of blue asbestos continued for longer in this country."

**1984** Importation of blue and brown asbestos banned in New Zealand.

**1987** Asbestos Regulations 1983, Amendment No.1, tightens provisions for medical examinations.



**1988** Thelma Bell (*pictured above*) widow of asbestosis victim, Clarrie, organises public meeting in Christchurch.

**1988** Barry Brown Secretary of the South Island Labourers Union arranges for Mavis Watson, occupational health nurse and Associate Professor Bill Glass from the Otago Medical School to interview ex-Fletcher workers from the Mandeville Street plant.

**1988** Cate Brett – Christchurch Star - highlights the tragedy of asbestos use.

**1989** Robin McKenzie, Engineer with NZED is diagnosed as suffering from mesothelioma in 1990, his lawyer took legal action against the Crown. Media coverage keeps up public concern.

**1990** *Review of Fletcher's Mandeville Street Factory* (unpublished). Glass W.I.

103 workers contacted.  
87 investigated.  
47 cases of asbestos related conditions (plus 7 probable cases).  
12 deaths to date.

**1990** Hon. Bill Birch, Minister of Labour establishes the Asbestos Advisory Committee in October to report on all aspects of asbestos exposure in New Zealand.

**1991** "Lung Cancer, Smoking and Exposure to Asbestos in New Zealand." Glass W.I., Kawachi I., Pearce N. *Journal of Occupational Health Safety* 7 (1).

"Case control studies based on NZ Cancer Registry showed that asbestos-related occupations were found to be associated with elevated risks of cancer in the lung, pleura and peritoneum. The risks of cancer in these three sites were highest among the group comprising machinery fitters, plumbers, welders, boilermakers, metal moulders, metal polishers and electricians."

**1991** Report of the Asbestos Advisory Committee presented to the Minister in April and Minister decides to implement the recommendations following Cabinet approval in August.



*Mr Robin McKenzie (left) and Mr Tim Frederiksen (right) important figures in raising awareness of asbestos related health problems.*

**1991** Tim Frederiksen establishes Asbestos Victim and Support Group, which later became the Asbestos Disease Association of New Zealand.

**1992** In March a National Asbestos Register was established (recommendation 4) of the Report. This Register was to be in two parts: Part 1 for those who had been exposed and Part 2 for those suffering from an asbestos related disease. The OSH section of the Dept of Labour was to administer the Registers.

**1992** ECNZ combines with the Department of Labour to publicise asbestos hazards.

**1992** An audit of floor sanders and work practices involving asbestos-backed vinyl sheeting in the Christchurch area was carried out by KD Sheat and published by OSH.

**1992** ACC lump sum entitlements ceased.

## ASBESTOS AWARENESS IN NEW ZEALAND (CONT)

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**1993** The 1st Annual Report of the National Asbestos Registers confirming 199 cases of asbestos related disease.

**1993(March)** Rights to initiate common law claims in regard to asbestos related conditions ceased.

**1993** ECNZ establishes model asbestos surveillance programme of current and past employees.

**1993** “Secondary” cases of asbestos disease occur in family members of asbestos workers whose only exposure was to dust brought to the home from the workplace.

**1994** The Second Annual Report reviews and confirms a total of 462 cases of asbestos related diseases.

**1994** Visit by Professor Margaret Becklake, International Asbestos Authority to advise on Registers.

**1995** Asbestos exposure and disease: notes for medical practitioners OSH.

**1995/96** The Third Annual Report confirms 535 cases.

**1996** The Management of Asbestos in the Non-Occupational Environment, Ministry of Health.

**1996/97** The Fourth Annual Report of the National Asbestos Register notes an increase in occurrence of mesothelioma cases.

**1997** The Asbestos Medical Panel publish its first report based on a review of asbestos cement exposed workers on the exposure register, 2257 notifications were reviewed. A positive finding was a non-significant association between cumulative asbestos exposure and a questionnaire diagnosis of asthma.

**1998** Health and Safety in Employment (Asbestos) Regulations 1998 promulgated.

**1999** Visit by Professor Corbett McDonald and Professor Alison McDonald to advise on updated information on mesothelioma.

**1999** Asbestos and the New Millennium. A publication prepared by Lois Syret and Ed Grootegoed on behalf of The Asbestos Association of New Zealand.

**2000** Mesothelioma in New Zealand, the second study by the National Asbestos Medical Panel.

**2000** Increased Mesothelioma Incidence in New Zealand. T. Kjellstrom, P. Smartt. NZMJ, November.

**2000** Lung function changes in Asbestos exposed workers with pleural plaques, the third study by the National Asbestos Medical Panel.

**2001** Asbestos New Zealand 2001, Lois J Syret and A H Grootegoed.

**2001** Occupational Safety and Health Review of Guidelines for the Management and Removal of Asbestos.

**2001** Asbestos Exposure in New Zealand Bill Glass New Ethicals. August.

**2003** The New Zealand National Asbestos Registers 1992 – 2001 Lessons Learned. Presented at Asbestos Symposium Seoul National University, Korea Bill Glass.

**2004** The Epidemic of Asbestos – Related Diseases in New Zealand. Int. J. Occup – Environ Health **10.2** June 2004 Tord Kjellstrom

**2004** Mortality and Morbidity in Asbestos Exposure in New Zealand : The Hidden Legacy of Asbestos Exposure. NZ Med J. **117** : **1205** P Smartt

## *Part 5 Asbestos Issues Ahead*

# ASBESTOS ISSUES AHEAD

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## *Floor Sanders*

In 1992 an audit of floor sanders and their working practices was carried out in Christchurch. This audit revealed a number of features:

- A failure to prevent spread of dust to other rooms
- Lack of a thorough "clean up" after sanding
- Poor respiratory protection for sanders
- Sanders taking asbestos dust home on their work clothes
- Transfer of dust from sanding machines to vehicles
- Careless disposal of sanding dust
- A general lack of understanding of asbestos

Overseas studies confirmed the New Zealand experience with high levels of asbestos dust measured in rooms during the sanding process.

## *Asbestos Removal Workers*

This group of workers was very active in the late 1980's and the 1990's. Although the Department of Labour published Guidelines for the management and removal of asbestos undoubtedly a proportion of such workers would have been exposed to significant amounts of asbestos for short or long term periods of time and some would have transported asbestos dust from work to home on their clothes, boots or body.

The National Exposure Register does not identify this group specifically yet they could well be the group at most risk and be the source of asbestos disease in the decades ahead.

## *Brake Lining Repair Workers*

Brake linings continue to consist of asbestos. Such work is frequently carried out in what are designated "small work places" and as such are less likely to be inspected and more likely to have inadequate local exhaust ventilation available. The work is intermittent and the dose may be long term and low level in contrast to demolition workers where it can be high level and short term. Nevertheless these workers comprise an ongoing "at risk group".

## ***Building Maintenance Workers***

It is of significance that the Health and Safety Executive (HSE) of Great Britain has recently published two related guidance booklets. One "Introduction to Asbestos Essentials" is specifically aimed at building maintenance workers.

The other "Asbestos Essentials Task Manual" is aimed at any worker who may come into contact with asbestos in the course of their work. Such workers include electricians, plumbers, computer installers, telecommunication engineers and the like.

## ***Demolition Workers***

The process of demolition is often carried out over a weekend and utilising casual labour. The presence of asbestos is not necessarily determined prior to the demolition and as a consequence no knowledge of exposure occurs.

*Part 6 Miscellany*

# OSH PUBLICATIONS ON ASBESTOS

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1. *Safe work on Asbestos-based Floor Coverings* 1985
2. *Talking Asbestos* 1987
3. *What Every Manager Should Know About Asbestos* 1991
4. *What Every Worker Should Know About Asbestos* 1991
5. *What Every Home Owner Should Know About Asbestos* 1991
6. *Safe Work on Asbestos-based Floor Coverings*. Leaflet, 1991
7. *Audit of Floor Sanders and Work Practices Involving Asbestos-backed Vinyl Sheeting in the Christchurch Area*. Occasional Paper Series No. 4, 1992.
8. *Recent Advances in Asbestos-Related Disease*. Dr Margaret Becklake, 1994. Special Report.
9. *Asbestos Exposure and Disease: Notes for Medical Practitioners*. Booklet, 1995.
10. *Guidelines for the Management and Removal of Abestos*. Booklet, 1995.
11. *The Epidemiology of Mesothelioma in Historical Context*. J.C. McDonald and A.D. McDonald, 1998. Special Report.
12. *Respiratory Symptoms and Asbestos Dust Exposure*. Occupational Health Report Series: No. 2, 1997.
13. *A Deadly Dust: 50 years of asbestos use in New Zealand*. Reprint from *Safeguard* magazine, December 1991, updated and reprinted 1999/2001.
14. *Mesothelioma in New Zealand*. Occupational Health Report Series No. 4, 2000.
15. *Lung Function Changes in Asbestos Exposed workers with Pleural Abnormalities*. Occupational Health Report Series No. 6, 2000.
16. *National Asbestos Registers, Annual Reports* 1992, 1993, 1995, 1997, 1998, 1999, 2002, 2004

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