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Mesothelioma is an unexpected, unpredictable and tragic consequence of asbestos exposure. The number of cases notified in New Zealand remains consistently high. This will be an under-estimate as Maori and Pacific Island workers are significantly under-notified.

Like other asbestos-related lung conditions, mesothelioma is usually dose related, although there are a small group of cases where a high exposure is not always reported.

At the Helsinki Conference on Monitoring and Surveillance of Asbestos – Related Diseases, in February 2014, Professor Ken Takahishi in a keynote presentation pointed out New Zealand’s high ranking for mesothelioma, when the figures are age-adjusted for the world population (Figure 1).

**ADJUSTED MORTALITY RATES***: MESOTHELIOMA
(person per million population – 1994-2010)

<table>
<thead>
<tr>
<th>RANK</th>
<th>COUNTRY [YEARS]</th>
<th>RATE*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Iceland (13)</td>
<td>24.6</td>
</tr>
<tr>
<td>2</td>
<td>Malta (15)</td>
<td>21.3</td>
</tr>
<tr>
<td>3</td>
<td>Bahrain (7)</td>
<td>20.5</td>
</tr>
<tr>
<td>4</td>
<td>United Kingdom (11)</td>
<td>18.4</td>
</tr>
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<td>5</td>
<td>Australia (8)</td>
<td>16.6</td>
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<td>6</td>
<td>Netherlands (15)</td>
<td>15.9</td>
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<tr>
<td>7</td>
<td>New Zealand (9)</td>
<td>13.9</td>
</tr>
<tr>
<td>8</td>
<td>Luxembourg (12)</td>
<td>13.6</td>
</tr>
<tr>
<td>9</td>
<td>Italy (5)</td>
<td>10.4</td>
</tr>
<tr>
<td>10</td>
<td>Belgium (5)</td>
<td>9.3</td>
</tr>
<tr>
<td></td>
<td>World Average (60 countries)</td>
<td>5.2</td>
</tr>
</tbody>
</table>

*age-adjusted to the world population
Other ranks: 12. Finland (15) 9.0; 27. USA (10) 5.6; 34. Japan (16) 3.2

Figure 1: Adjusted mortality rates: Mesothelioma

Canterbury Rebuild maintained its high focus on asbestos exposure following two severe earthquakes in 2010 and 2011, and the consequent demolition and removal of damaged homes.

At the request of the Ministry of Health, WorkSafe New Zealand has modified its asbestos exposure form to include questions concerning non work-related asbestos exposure. This form is now available both online and in hard copy.

**National Asbestos Medical Panel**
Dr W. I. Glass (Convenor)
Dr R. Armstrong
Dr D. Jones
Dr M. Epton
Dr D. Milne

November 2014
SUMMARY OF ASBESTOS-RELATED CHANGES

Compared with the previous year’s Annual Report:

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Mesothelioma</td>
<td>232</td>
<td>245</td>
<td>13</td>
</tr>
<tr>
<td>Lung cancer</td>
<td>124</td>
<td>129</td>
<td>5</td>
</tr>
<tr>
<td>Asbestosis</td>
<td>294</td>
<td>315</td>
<td>21</td>
</tr>
<tr>
<td>Pleural Abnormalities</td>
<td>649</td>
<td>677</td>
<td>28</td>
</tr>
<tr>
<td>Total</td>
<td>1299</td>
<td>1366</td>
<td>67</td>
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</table>

Table 1: Categories of notified occupational lung diseases

<table>
<thead>
<tr>
<th>YEAR</th>
<th>NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>81</td>
</tr>
<tr>
<td>2004</td>
<td>84</td>
</tr>
<tr>
<td>2005</td>
<td>103</td>
</tr>
<tr>
<td>2006</td>
<td>99</td>
</tr>
<tr>
<td>2007</td>
<td>91</td>
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<td>2008</td>
<td>99</td>
</tr>
<tr>
<td>2009</td>
<td>91</td>
</tr>
<tr>
<td>2010</td>
<td>90</td>
</tr>
<tr>
<td>2011</td>
<td>78</td>
</tr>
</tbody>
</table>

Table 2: National cancer figures for mesothelioma
1
ASBESTOS
WHAT IS ASBESTOS?

Asbestos is a term used to describe naturally occurring fibrous hydrated silicates of which there are six common varieties.

Figure 2 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 makes them useful for weaving, and they 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 into 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 than blue or brown fibres.

Crocidolite (iron-sodium silicate) fibres are straight and rigid and can split longitudinally. They are more resistant to body fluids and can survive unchanged in the body for up to 40 years or more. 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. Again, the fibres remain unchanged in the body for years.
ASBESTOS AWARENESS IN NEW ZEALAND

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 the survey:

“207 workers surveyed. 101 workers x-rayed. 17 showed pleural changes (one case later confirmed as asbestosis).”

1977 Environmental Dust Laboratory established to identify asbestos fibres in air.

1978 Asbestos Regulations promulgated.

1981 The allowable concentration for asbestos fibres (other than crocidolite fibres) is reduced from 2 fibres/ml to 1 fibre/ml. Crocidolite remains at 0.2 fibres/ml over a 10-minute sampling period.

1982 Jim Butterworth, Auckland Secretary, New Zealand Engineers Union, expresses concern about the long-term effects of asbestos on workers at James Hardie factory.

1983 Interim Report of Workers at James Hardie (unpublished) T. Kjellstrom, F. Rennie. Of 353 workers x-rayed, 53 showed parenchymal (functional) and/or pleural changes. An increasing percentage of abnormalities found over time since first exposure. Asbestos Regulations replace 1978 regulations. A New Zealand Gazette notice reduces the 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.”

Importation of blue and brown asbestos is banned in New Zealand.

1988  Thelma Bell, widow of asbestosis victim Clarrie, organises a public meeting in Christchurch. Barry Brown, Secretary of the South Island Labourers Union, arranges for Maevis Watson, Occupational Health Nurse, and Associate Professor Bill Glass from the Otago Medical School, to interview ex-Fletcher workers from the Mandeville Street plant. Cate Brett - *Christchurch Star* - highlights the tragedy of asbestos use.

1989  Robin McKenzie, Engineer with NZED (New Zealand Electricity Department), 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). W.I. Glass. 103 workers contacted. 87 investigated. 47 cases of asbestos-related conditions (plus 7 probable cases). 12 deaths to date.

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


“Case control studies based on New Zealand 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.”

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

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

1992  In March, a National Asbestos Register is 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 Occupational Safety and Health Service of the Department of Labour is appointed to administer the registers.

ECNZ (Electricity Corporation of New Zealand) combines with the Department of Labour to publicise asbestos hazards.

An audit of floor sanders and work practices involving asbestos-backed vinyl sheeting in the Christchurch area is carried out by K.D. Sheat and published by the Department of Labour.

ACC lump sum entitlements for asbestos-related claims cease.

1993  The first Annual Report of the National Asbestos Registers confirms 199 cases of asbestos-related disease.

(March) Rights to initiate common-law claims in regard to asbestos-related conditions cease.

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

Secondary cases of asbestos disease are found to occur in family members of asbestos workers. Their 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.

Visit by Professor Margaret Becklake, International Asbestos Authority, to advise on the registers.

1995  *Asbestos Exposure and Disease: Notes for Medical Practitioners* is published by the Department of Labour.

1995/96  The third Annual Report confirms 535 cases.


1996/97  The fourth Annual Report of the National Asbestos Register notes an increase in occurrence of mesothelioma cases.
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>The Asbestos Medical Panel publishes its first report, based on a review of asbestos cement-exposed workers on the Exposure Register. 2257 notifications are reviewed. A positive finding is a non-specific association between cumulative asbestos exposure and a questionnaire diagnosis of asthma.</td>
</tr>
</tbody>
</table>
| 1999 | Visit by Professor Corbett McDonald and Professor Alison McDonald to advise on updated information on mesothelioma.  
| 2000 | *Mesothelioma in New Zealand*, the second study by the National Asbestos Medical Panel, is published.  
*Increased Mesothelioma Incidence in New Zealand*. T. Kjellstrom, P. Smartt.  
*New Zealand Medical Journal*, November  
*Lung Function Changes in Asbestos-Exposed Workers with Pleural Plaques*, the third study by the National Asbestos Medical Panel, is published. |
Occupational Safety and Health (Department of Labour) publishes the *Review of Guidelines for the Management and Removal of Asbestos*.  
*The Epidemic of Asbestos-related Diseases in New Zealand*. T. Kjellstrom.  
| 2010 | Ed Grootegoed, Chairman of the Asbestos Diseases Association of New Zealand (Inc), passed away in May. Ed did much to highlight the asbestos tragedy in New Zealand, in particular his concern at the dumping of asbestos and rebuilding on old dump sites. |
| 2011 | Professor Ken Takahashi from the University of Occupational and Environmental Health, Kitakyushu City, in Japan, visits New Zealand for the Federal ANZSOM conference in Wellington and spoke on *Global Mesothelioma Deaths Reported to the World Health Organisation between 1994 and 2008*.  
| 2012 | Dr Michael Donoghue, Medical Director of ALCOA World Alumina, is a guest speaker at the Update on Occupational Respiratory Disease meeting. He spoke on *Occupational Asthma in the Aluminium Smelters of Australia and New Zealand: 1991-2006*. |
| 2014 | Professor Ken Takahashi reported to the Helsinki International Conference on *Monitoring and Surveillance of Asbestos – Related Diseases*, that New Zealand was seventh in the world for adjusted mortality rates for mesothelioma. |
THE 2010 AND 2011 CANTERBURY EARTHQUakes

On Saturday 4 September 2010, a 7.1 magnitude earthquake struck the South Island, 40 kilometres west of Christchurch. Some buildings in Christchurch and surrounding areas were badly damaged, and a small number of people were injured.

On Tuesday 22 February 2011, a 6.3 magnitude earthquake struck 10 kilometres south-east of Christchurch. It caused widespread damage across Christchurch, particularly the central city and eastern suburbs. The earthquake occurred at 12.51pm, a time when many people were working, having lunch or shopping in the city. Two buildings completely collapsed, and 185 people were killed.

Another 6.3 magnitude earthquake occurred on 13 June 2011, and affected buildings already damaged by the previous earthquakes. 46 people were injured.

The devastation wrought by these earthquakes and multiple aftershocks has given rise to the extraordinary increase in demolition and rebuilding that is still continuing strongly. Occupations most at risk of exposure to asbestos are demolition workers and people involved in building renovation. There is also a concern with house owners who go ahead and carry out their own renovations, as well as a low but potential risk to household members.

WorkSafe is actively engaged in ensuring exposure risks are minimised and is monitoring reporting of restricted work and the asbestos exposure register. These are two key indicators which the Agency uses to inform its operational programmes.

WORKSAFE’S RESPONSE TO THE CANTERBURY REBUILD

This has been a multi-pronged approach; educational, organisational and inspectorate. Activities have included the following:

- **February 2011**: Specific fact sheets developed for dealing with asbestos in the immediate aftermath of the September and February earthquakes.
- **2012**: More than 400 people attend several education sessions on working with asbestos in the rebuild. The focus of these sessions being on asbestos risks, the potential health effects and information on how asbestos can be managed.
- **6 August 2013**: Organised by Ministry of Business, Innovation & Employment’s Canterbury Rebuild Health and Safety Programme and Massey University’s Centre for Public Health Research, more than 100 people attend an occupational health seminar on rebuild health hazards such as noise at work, asbestos and concrete dust and silica.
- **4 October 2013**: Close to 400 people attend a MBIE trade breakfast and a later lunch session on asbestos in the rebuild, focusing on health hazards, testing and sampling, respiratory PPE, legal requirements and certificates of competence. Watch the event online: [http://www.business.govt.nz/healthandsafetygroup/information-guidance/national-programmes/the-canterbury-re-build/events](http://www.business.govt.nz/healthandsafetygroup/information-guidance/national-programmes/the-canterbury-re-build/events)
4 November 2013: MBIE issues a media release with Canterbury Medical Officer of Health Dr Alistair Humphrey about concerns about asbestos practices in the rebuild. The media release is available online: http://www.business.govt.nz/worksafe/news/releases/2013/authorities-concerned-at-asbestos-management-in-canterbury-rebuild


May 2014: WorkSafe releases an ‘Asbestos Toolkit’ made up of eight factsheets on asbestos. More than 3,000 copies of the toolkit have been printed and released throughout Canterbury and New Zealand. The toolkit is available online: http://www.business.govt.nz/worksafe/information-guidance/all-guidance-items/asbestos-factsheets

WorkSafe has also worked closely with a number of asbestos contractors on their Certificates of Competence and has been assessing their compliance with these certificates. This includes assessing the systems, procedures and on site activity of certified personnel – to ensure those people carrying out asbestos work are complying with the correct standards.

Assessment visits by WorkSafe inspectors to construction sites in Canterbury focused on the four key target areas (asbestos, falls from height, mobile plant and excavations) have increased significantly:
- 399 in 2012
- 704 in 2013
- 713 from 1 January to 31 May 2014 alone.

ASBESTOS CERTIFICATE OF COMPETENCE ASSESSOR (COC) TRAINING

Work involving asbestos has become an increasingly important aspect of the Canterbury rebuild with up-to 40,000 homes containing some form of asbestos. Asbestos-related repair work has required WorkSafe to work closely with those undertaking work with friable asbestos and confirm best practice. The increased activity with restricted asbestos work has also required many more certificates of competency to be issued which has resulted in the need to refine the issuance process and clarify WorkSafe’s expectations with respect to the previous experience of applicants.

WorkSafe has continued to provide training for its own staff who assess applicants for the CoCs, or who may be working with the CoC holders. So far approximately 40 staff
have been provided with a three day training program to enable them to understand the risks and mitigation strategies when working with friable asbestos. Although some of these staff have since left the organisation, WorkSafe is now better resourced to deal with the challenges posed when undertaking restricted asbestos work.

WORKSAFE NEW ZEALAND AND GOVERNMENT INITIATIVES WITH ASBESTOS

ASBESTOS REGULATIONS

Late in 2013 MBIE, indicated that it was proposing a review of the Asbestos Regulations as a priority area under the Working Safer package of reforms. A guidance group was convened by WorkSafe and MBIE to advise on the scope and content of new asbestos regulations and related guidance.

ASBESTOS (OFFICIALS) COORDINATION GROUP

The Coordination Group was convened by the Department of the Prime Minister and Cabinet. Its purpose is to coordinate actions across government and agencies. Represented are the Department of the Prime Minister and Cabinet, the Ministry of Business, Innovation and Employment, the Ministry of Health, WorkSafe, the Earthquake Commission and the Canterbury District Health Board.

ASBESTOS TECHNICAL ADVISORY GROUP

Established in 2014, the purpose of this Technical Advisory Group is to provide information to the Coordination Group on a wide range of asbestos background information to enable, among other things – government agencies to respond “with one voice” to public concerns about asbestos, whether at work or in the home. The Committee is chaired by Dr Fran McGrath from the Ministry of Health, and includes Associate Professor Tim Driscoll (University of Sydney), Professor Bill Glass (Centre for Public Health Research, Massey University and WorkSafe), Linda Dwyer (Capital Environmental Services Ltd), Dr Daniel Williams (Medical Officer of Health/ Clinical Lead, Canterbury Public Health) and Greg Baker (Fire and Structural Engineering Manager, BRANZ).

SIR PETER GLUCKMAN

A further expert report has been commissioned by the Ministry of Health to focus on asbestos exposure related to home renovation. Sir Peter Gluckman has been commissioned to prepare this report assisted by the Royal Society of New Zealand.

WORKSAFE NEW ZEALAND – ASBESTOS GROUP MEETING

This Group was set up in 2013 to respond to a range of practical issues arising from the Canterbury Rebuild. These have included an emphasis on the training and competence of asbestos removal operatives and the training of inspectors under the supervision of the removalists. The Group has input into the proposed Asbestos Regulations development.
REVIEW OF ASBESTOS-RELATED DISEASE NOTIFICATIONS
SUMMARY

This report reviews 1366 cases that were notified to the National Asbestos Medical Panel between March 1992 and July 2013. They include:

- 245 cases of mesothelioma
- 129 cases of lung cancer
- 315 cases of asbestosis
- 677 cases of pleural abnormalities.

The number of lung cancer cases reported is roughly half of the number of mesothelioma cases. This suggests that the recording of a lung cancer history is still dominated by the smoking factor, and that occupational factors are downplayed.

Repairing or renovating hundreds of earthquake-damaged properties is a major task for residential and commercial building owners. With the “housing stock” in Christchurch older than elsewhere in New Zealand, asbestos exposure for renovators is an important issue.

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

Figure 3 shows the distribution of the four main diagnostic categories: lung cancer

- lung cancer
- pleural disease
- asbestosis
- mesothelioma.

![Pie chart showing disease distribution.](chart.jpg)

**Figure 3:** Categories of disease 1992-2013

What is noticeable is that pleural disease is the main category, with lung cancer clearly under-represented when compared with mesothelioma.
Figure 4 looks at occupations for the total number of notified asbestos disease cases during the period.

It is clear that carpenters, plumbers and electricians are together responsible for 67% of all cases. These ‘all purpose’ construction workers are an occupational category at risk particularly because, unlike asbestos cement workers, they are not always seen as being at obvious risk.

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 people who washed asbestos-contaminated clothes. The ‘no known exposure’ category refers predominantly to mesothelioma cases where conclusive exposure histories were not available.

(Note: the time delay is often 40-50 years from exposure and has either been forgotten, never recognised, or not known by the surviving family member).
Mesothelioma – a rare cancer of the pleural membranes on the surface of the lungs – is strongly related to asbestos exposure. The panel reviewed 245 cases of mesothelioma, of which:

- 236 were Caucasian
- 6 were Maori
- 3 were identified as ‘Other’
- 229 were males, 16 were females
- the mean age at diagnosis was 68 years (range 35-85)
- the mean number of years since first exposure was 45 (range 12-74)
- the mean exposure index was 180 (range 1-780)
- there were 22 current smokers, 134 ex-smokers and 63 never-smokers (information for 26 cases was unavailable).

Asbestos processors, plumbers/fitters/liggers, and carpenters/builders, accounted for over 60% of all registered cases.
Over the period from 1954 to 2011, a total of 1696 cases of mesothelioma were registered. Figure 6 shows that the total number of cases continued to rise and in 2005 it exceeded 100 for the first time. However, since then the number of cases has reduced with 78 reported in 2011.

Mesothelioma is very much a disease of old age as Table 3 illustrates, with 49% of cases occurring to people aged 70 or over.

<table>
<thead>
<tr>
<th>Gender</th>
<th>&lt; 50</th>
<th>50s</th>
<th>60s</th>
<th>70s</th>
<th>&gt; 80</th>
<th>Total</th>
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<tbody>
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<td>Female</td>
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<td>26</td>
<td>42</td>
<td>53</td>
<td>44</td>
<td>183</td>
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<tr>
<td>Male</td>
<td>22</td>
<td>153</td>
<td>358</td>
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<td>1155</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>179</td>
<td>400</td>
<td>470</td>
<td>249</td>
<td>1338</td>
</tr>
</tbody>
</table>

Table 3: Mesothelioma occurrence by age range 1994-2011

Of the 1338 cases between 1994 and 2011, 183 occurred to women and 1155 to men. As women are seldom employed directly in the asbestos-exposed workplaces, their exposure could be as a result of “secondary” exposure to dust brought home from work on the hair and clothes of family members.
Figure 7: Distribution of lung cancer by occupation

Lung cancer is a cancer of some of the cells in parts of the lung, usually beginning in the lining of the airway.

The panel reviewed a total of 129 cases of lung cancer, of which:

› 123 were Caucasian
› 4 were Maori
› 1 was from a Pacific Island
› 1 was identified as ‘Other’
› 127 were males, 2 were females
› the mean age at diagnosis was 69 (range 42-86)
› the mean number of years since first exposure was 46 (range 17-63)
› the mean exposure index was 165 (range 12-565)
› there were 28 current smokers, 89 ex-smokers, 8 never smokers and 4 unknown.

The occupational distribution of lung cancer follows a similar pattern to both pleural plaques and asbestosis, in that plumbers, fitters, carpenters and asbestos processors account for most of the cases.
Figure 8: Distribution of asbestosis notifications by occupation

Asbestosis is a fibrotic or scarring disease of the lung tissue. The disease develops slowly over many years from initial exposure. It can continue to develop after exposure to asbestos has ceased.

The panel reviewed a total of 315 cases of asbestosis, of which:

- 311 were Caucasian
- 2 were Maori
- 2 were from a Pacific Island
- 299 were males, 16 were females
- the mean age at diagnosis was 68 (range 37-86)
- the mean number of years since first exposure was 43 (range 15-71)
- the mean exposure index was 180 (range 10-720)
- there were 23 current smokers, 224 ex-smokers and 62 never smokers (accurate smoking histories were not available in 6 cases)
- radiological changes showed 193 cases with pleural plaques and/or pleural thickening.

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. As noted, HRCT diagnosis is now the norm.
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. The replacement of CXR’s with HRCT has led to this change.

The definition of Gilson’s in his review of asbestosis-related lung conditions in the ILO encyclopaedia has been chosen by the panel 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, and
(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, and (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 most common pattern (about 40%), in about 10% of cases airway obstruction is the main feature, while in the remainder a mixed pattern is seen.

PLEURAL ABNORMALITIES

Pleural abnormalities include 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.

Of the 677 cases reviewed:
› 665 were Caucasian
› 8 were Maori
› 4 were from Pacific Islands
› all but 10 were males
› the mean exposure index was 162 (range 6-708)
› there were 63 smokers, 400 ex-smokers and 170 never smokers (accurate smoking histories were not available in 44 cases).
Information recorded in the Disease Register under-estimates the total burden of asbestos-related disease in New Zealand. This is a consequence of the voluntary nature of the Register, lack of understanding of work as a factor in disease causation by the medical profession, and failure by the Cancer Registry to code occupation in their database.

However, the Register continues to serve an important purpose. There is now greater awareness of the work factor in disease than in 1992 when the Register was established. WorkSafe now has greater commitment to the importance of occupational illnesses; the Accident Compensation Corporation employs a greater number of occupational doctors, and there are increasing numbers of occupational nurses and medical officers in the private sector.

The Registers’ – part of the wider Notifiable Occupational Disease System (NODS) operated by WorkSafe 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 *then-Department of Labour* publication *Lung Function Changes in Asbestos Exposed Workers with Pleural Abnormalities* in 2000 indicated a clear dose-response pattern, including a reduction of FVC and FEV1 with increasing asbestos exposure, independent of smoking habit.

**ASBESTOSIS**

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 under-estimated, and over-attributed to smoking among workers exposed to asbestos. One approach to this issue is to determine the ratio between mesothelioma and lung cancer on the grounds that most mesotheliomas are diagnosed and the majority are regarded as being caused by asbestos exposure at work. Various estimates of such a ratio have been suggested with a range from one to 10. Even if the lower ratio of 1:1 is taken – based on the 1338 mesothelioma cases, diagnosed over 1994-2011, for example a similar number of cases of lung cancer due to asbestos exposure would have occurred.
MESOTHELIOMA
Reported cases of mesothelioma have continued to rise in New Zealand over the past decade as shown in Figure 6, and based on the New Zealand Cancer Registry. It is of interest to note the mean exposure index for mesothelioma of 152 – as recorded by the panel – is not dissimilar to exposure indices for pleural plaques (162), lung cancer (162) and asbestosis (180). In other words, mesothelioma, like other asbestos-related conditions, is in general dose-dependent.

CHRONIC OBSTRUCTION PULMONARY DISEASES (COPD) AND ASBESTOS EXPOSURE
These conditions are now being recorded if present in individuals with an asbestos-related disease, as well as in those asbestos-exposed workers who have no confirmed asbestos-related lung or pleural disease.

A CASE HISTORY – ASBESTOS, PAST EXPOSURE, PRESENT DISEASE
At times, cases on the disease register provide graphic accounts of asbestos exposure and this is an example of one individual’s different jobs in his own words:

1. WORKING FOR AN INSULATION COMPANY
Empty sack (20kg) raw asbestos (chrysotile and amosite) into hopper. Mix PVA glue and water, into spray product using compressor spray system. Very dusty work as asbestos was not wet until it actually sprayed out from the nozzle and had mixed with the glue. Outlet nozzle held ½ metre from structured steel product called ‘silbestos’. Respirator provided thin aluminium shield with gauze/cotton wool filter, very ineffective, thrown away after five minutes as couldn’t breathe through them, no overalls, no gloves, made calico cover for hair to protect from glue rather than asbestos, washed own overalls.

2. HARDSETTING PLASTERS
Used an asbestos cement mixture. Hand mixed in buckets. Opened bag of asbestos, tipped into bucket, mixed with water with bare hands. Many workers got asbestos warts as fibre would penetrate skin. Hand trowelled on to insulation product as protective agent.

3. ZEALITE SWITCHBOARDS
Operated press that made asbestos board for inside switchboards. It was in 1974 that it was first heard that the product (asbestos) was dangerous to health. Owner reassured staff that white was safe – other types dangerous.
PART 3 // OCCUPATIONAL RESPIRATORY DISEASE

3

OCCUPATIONAL RESPIRATORY DISEASE
There has been little emphasis on the importance of occupational asthma, silicosis and work-related chronic obstructive respiratory disease in New Zealand until recent years. However, there is an historical base to occupational respiratory disease as referenced below:

1938
Silicosis: Report of Interdepartmental Committee, Bulletin No 57, Department of Scientific and Industrial Research, Wellington\(^2\).

This report noted that since the 1915 Miners’ Phthisis Act, 1,576 miners had been granted pensions as a result of silicosis; of those, 1,508 were described as gold miners and 68 as coal miners.

1940s
A record of tuberculosis morbidity in hospital nurses recorded in the book Challenge for Health by Dr F.S. McLean\(^3\) showed a morbidity rate per 1,000 nursing staff which ranged from 8.9 to 20.3, averaging 16.5 over the years 1943-1949.

1961
The Grey Valley Survey\(^4\) in which Dr Francis de Hamel surveyed 1,524 miners and ex-miners in the coal industry during 1958 revealed only 32 cases of pneumoconiosis, not all of whom had worked in New Zealand coal mines.

The 1990s
This period saw a significant output of publications on non-asbestos occupational respiratory disease, largely due to Professor Neil Pearce of the Centre for Public Health Research at Massey University, together with Dr David Fishwick and Lisa Bradshaw. Over this period occupational asthma was investigated nationally\(^5\) among farmers\(^6-11\), sawmill workers\(^9-11\) and aluminium workers\(^12-14\); at the same time respiratory symptoms, lung function and dust levels were measured in the wood industry\(^15/16\), plywood mill workers\(^17/18\), hairdressers\(^19\), mussel openers\(^20\), welders\(^21-28\) and quarry workers\(^29\).

2000
In 2000, Dr Jeroen Douwes joined the Centre, accelerating the interest in sawmill workers, wood dust and respiratory effects.

24 American Journal of Industrial Medicine 1994; 51: 553-556.
29 New Zealand Medical Journal 2004; May 7: 117(1193): U872.
OCCUPATIONAL ASTHMA

In the Colt Lecture given by Anthony Newman Taylor at the Ninth International Symposium on Inhaled Particles at Cambridge University in 2001\(^{30}\), Professor Taylor noted some key points about this disease:

- asthma is the most prevalent cause in the United Kingdom, and probably in the western world, of respiratory ill health during working life
- asthma consists of variable airflow limitation, reversibility and hyper-responsiveness of the airways
- asthma can be induced by direct toxic damage to the lining of the airways (irritant inducers) or the RADS phenomenon, or as a result of a specific hypersensitivity response to inhaled proteins and low molecular-weight chemicals
- asthma can be incited in persons who already have hyper-responsive airways when exposed to pollutants in the workplace air
- evidence is strong that the risk of developing occupational asthma is determined more by the level of exposure to the risk factor than by individual susceptibility
- asthma induced by work exposures carries a high risk of progression to chronic asthma
- there is evidence that the extent of occupational asthma can be reduced by reducing the airborne concentration of the causative agents.

The current programme of WorkSafe to investigate dirty workplace air is a practical response to the accumulating evidence relating to the causes of work-related asthma.

In New Zealand, a debate frequently occurs regarding work-aggravated asthma (WAA), and work-induced asthma (occupational asthma), largely related to whether a compensation claim is accepted or not. While this debate may be relevant to the issue of compensation, it is clearly not relevant to reducing and minimising the impact of asthma at work. This is because both work-aggravated and work-induced asthma are a consequence of exposure to dirty workplace air, and the outcome of both types of asthma is seen in lost time from work. The possibility is that what begins as asthma may in time, if exposure continues, lead to a lack of reversibility and the development of chronic obstructive pulmonary disease.

In confirming a case of occupational asthma, the Panel requires the following:

- a diagnosis of asthma
- asthma occurring for the first time at work (work-induced asthma) or asthma made worse at work (work-aggravated asthma)
- a work history of exposure to an asthagen or to a substance that can irritate the respiratory tract
- supportive peak flow records indicating a temporal relationship between work and symptoms/peak flow
- evidence of reversibility.

CASE STUDY – AN UNUSUAL CASE OF ASTHMA (RADS)

Mr X painted over the wallpaper in a bedroom with imported enamel paint. It took some two hours. The window was open, the door shut and stopped with a towel at the bottom gap. This was done because of the pungent smell which Mr X’s wife found objectionable. The door to the bedroom remained shut overnight.

The next day it was discovered that the paint had not dried and a heater was placed in the room. This was not effective and on Day three, Mr and Mrs X spent two hours scraping, removing and bagging the painted wallpaper and the underlying base paper. They each wore a P2 mask. The odour remained in the home over a period.

During the night following the painting, Mrs X woke with a choking feeling. The next morning she felt a burning feeling in her windpipe and chest. The burning sensation in her chest continued in spite of moving out of her house. In addition her skin was itchy, her lips numb and she was giddy and headachy. She was also short of breath on exertion, fatigued and nauseous.

Mrs X saw a respiratory physician six weeks after her problem first began. He reported that a chest x-ray four weeks after her initial symptoms was normal. The physician noted that Mrs X had now become sensitised to other fumes and reacted to petrol fumes, some perfumes and cleaning agents.

In spite of efforts to ventilate her home, she cannot return, finding that she reacts to residential chemicals and smells. She is a non-smoker and prior to this episode was in good respiratory health.

The physician concluded that “her presentation is consistent with reactive airways dysfunction syndrome (RADS) due to the exposure to the unusual mixture of chemicals in the paint fumes”.

The paint was blue enamel imported from overseas. The paint was analysed for volatile organic compounds (VOC’s). Compounds detected included styrene, xylene, alkyl-styrenes, alkyl-benzenes, indene and methyl indene and naphthalene. The odour was attributed to the presence of dicyclopentadiene (DCPD).

The National Poisons Centre was consulted and Dr Michael Beasley noted, “DCPD has an odour threshold reportedly as low as 0.003 parts per million (ppm).

In conclusion, it is noted that the diagnosis was made clinically; the exposure was mixed but included not only DCPD as a significant odour component but also styrene as a possible contributor to the nausea and headache.

Complete recovery had not occurred some 12 months after this episode. Mr X was less severely affected.
CHRONIC OBSTRUCTIVE PULMONARY DISEASE

Chronic obstructive respiratory disease (CORD), or chronic obstructive pulmonary disease (COPD), as it is now more commonly referred to, “is the fourth leading cause of death worldwide”\(^\text{31}\)\(^\text{)\). It is defined as a condition with airflow limitation which is not fully reversible, is progressive and is associated with an abnormal inflammatory response of the lungs to noxious particles or gases. Historically, and still, the major cause is cigarette smoking.

However, there is increasing evidence indicating that exposure to dusts, gases, and fumes at work are linked to the development of COPD. As a result, it is now recognised as an occupational disease in certain situations, with likely additive effects occurring between smoking and some workplace exposures.

Contaminants of air associated in studies with work-related COPD include: welding fumes, silica, coal, oil mist, Portland cement, cotton, grain and wood dusts\(^\text{32}\)\(^\text{).}

Diagnosis of COPD requires both a clinical and occupational approach and as far as the latter is concerned, a careful occupational history. That is, a chronological list of jobs, what the job entailed, which respiratory exposures occurred, to what extent and for how long.

As a consequence, the panel is now not only recording the presence of COPD in asbestos-diagnosed cases, but also in asbestos-exposed and non-asbestos exposed cases.

Again, in the rebuilding in Christchurch, occupations such as welding and concrete drilling, cutting and grinding could lead to increased exposure and health risk.

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SILICA AND SILICOSIS – ONE AGENT, MANY OUTCOMES

Silica is the most common element found in the earth’s crust. When combined with other substances, silica is relatively harmless. Silicosis is a serious lung condition described by the ILO as an accumulation of crystalline silica dust in the lungs and the tissue reaction to its presence. It is caused by inhaling airborne crystalline silica dust in high concentrations over a period of time.

In a review of the outcome of silica exposure, Steenland noted “evidence in recent years indicates that silica causes lung cancer, and probably renal disease, in addition to its well-known relationship to silicosis” and, as indicated in the previous section, it can also result in Chronic Obstructive Pulmonary Disease.

While silicosis is rarely diagnosed in New Zealand, there is evidence that most New Zealand rocks contain some quartz, and with erosion and quarrying, the quartose sands tend to contain a higher content of quartz than the parent material. This was re-affirmed in an extractive industry study where the dust measurements carried out by the Department of Labour showed that in 13% of the air samples collected, levels of respirable quartz exceeded 0.2mg/m³ (the current New Zealand Workplace Exposure Standard).

If asbestos is an historic issue which has raised its head again in the Canterbury Rebuild, silica is a very current one. The use of concrete and the activities of cutting, drilling and grinding is widespread in the rebuilding of Christchurch, and with the increased emphasis on strengthening buildings to comply with enhanced earthquake standards, it is a national issue.

Dry cutting, grinding and drilling is still common, particularly in short-term (one to three day) tasks, such as putting in new concrete floors in retail sites or cutting and drilling into established concrete structures in order to strengthen or alter them.

Not only are the workers exposed to concrete dust, which can contain Respirable Crystalline Silica (RCS), but they are also exposed to noise, vibration and associated health hazards.

EVALUATING WET VERSUS DRY METHODS OF CONCRETE CUTTING AND DRILLING

With the cooperation of a concrete cutting firm, conscious of the silica dust risk, a small study was carried out by Kerry Cheung and Professor Bill Glass of Massey University’s Centre for Public Health Research. This project was undertaken over two days in Nelson in June 2013.

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14 Exposure to Alpha Quartz Dust in New Zealand Industries. E. Nicol. Occupational Health 1982; 41, 30-36.
Three workers were involved. Personal samplers were worn during specified tasks and video monitoring of the activities recorded. The results indicated that all personal representative silica samples were below New Zealand’s current Workplace Exposure Standard (WES) of 0.2mg/m³ but above the American ACGIH threshold limit value of 0.025 mg/m³.

It was noted that the New Zealand WES was one of the highest in the OECD but on the positive side, WorkSafe is currently reviewing this standard.

The video monitoring showed quite clearly that wet methods of concrete work were more effective at reducing the number of peak exposures than dry methods.

As far as inhalable concrete dust exposure was concerned, wet methods reduced exposure levels by over 90%.

As a result of this pilot study a more extensive project will be undertaken in Christchurch in 2014.

**SILICA DUST IN CONSTRUCTION**

As part of the ongoing education programme relating to the Canterbury Rebuild and throughout New Zealand, WorkSafe has produced a factsheet on the health hazards of silica dust in construction. A link to the factsheet is as follows: [http://www.business.govt.nz/worksafe/information-guidance/all-guidance-items/silica-dust-in-construction-fact-sheet](http://www.business.govt.nz/worksafe/information-guidance/all-guidance-items/silica-dust-in-construction-fact-sheet)
APPENDIX 1

CONTACT DETAILS FOR THE ASBESTOS AND OCCUPATIONAL RESPIRATORY DISEASE REGISTRAR
The Registrar, New Zealand Asbestos Registers
WorkSafe New Zealand
PO Box 165
Wellington 6140
Email: healthsafety.notification@worksafe.govt.nz
Fax: 09 984 4115
Phone: 0800 030 040

MEMBERS OF THE NATIONAL ASBESTOS MEDICAL PANEL
W.I. Glass (Convenor)
R. Armstrong
M. Epton
D. Jones
D Milne
APPENDIX 2

THE NATIONAL ASBESTOS REGISTERS

The National Asbestos Registers were established in March 1992 in line with 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 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 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 (formerly the Occupational Safety and Health Service of the Department of Labour, now WorkSafe New Zealand) 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 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 Occupational Disease System (NODS) was established in 1992 and the Asbestos Registers have been incorporated in that scheme. This was in accordance with recommendation 5 of the Asbestos Advisory Committee.
The Ministry, in association with Electricorp Production Ltd, undertook an extensive advertising campaign in March and April 1992. Advertisements were published in all the major newspapers and several trade magazines.

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

Notifications were directed to branch offices of the Ministry or directly to the Registrar.

**THE EXPOSURE REGISTER**

In recommendation 4, the committee envisaged that people wishing to be recorded on the Asbestos Exposure Register would have their exposure assessed at an office of the Department. Only those people who were judged as having had ‘significant exposure’ would then be recorded on the Register.

However, the huge response from individuals exposed made it impractical to screen registrants in this fashion.

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

When the completed form is returned to the registrar, the details are recorded on a database. The individual is then sent a copy of *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 their patient has been included on the Asbestos Exposure Register, and is sent a copy of the Ministry’s booklet *Asbestos Exposure and Disease: Notes for Medical Practitioners.*
Figure 11: Asbestos Disease Register Process

THE 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.

Professor 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. In 2008, Andrew Brant joined the Panel, later resigning to become Chief Health Officer at North Shore Hospital.

The first meeting of the panel was held in February 1992. 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 and Dr Graeme Anderson.

The Registrar from 1991 to 1996 was Craig Eades. From 1996 to 1998 the position was held by Nicola Holden, and later in the year by Andrea Eng until 1999 when Louisa Thomas was appointed.

PROCESSES FOR REGISTERING PEOPLE

Notifications for the register come from two major sources. The first is from doctors whose patients have been diagnosed or are suspected of having an asbestos-related disease. The second source of notification is from individuals. Once a notification is made to the Registrar, and consent gained from the person concerned, relevant medical records and a full occupational history are obtained.

DATA COLLECTION

The data collected includes a medical history, occupational history, chest x-ray, CT scan where available, lung function tests and pathology reports. On notification being received by the Registrar:

› An occupational health nurse visits the patient and conducts a health interview, a detailed occupational and social (including smoking) history.
› Relevant medical reports are obtained from general practitioners and physicians.
› A PA chest x-ray is obtained and read by a radiologist according to ILO (1980) guidelines. CTs are used where available, and on occasions requested.
› Lung function data is obtained from physicians’ reports or requested from respiratory laboratories. Where this is not possible, results are obtained from a test carried out by an occupational health nurse, using a portable spirometer.
› Pathology and post-mortem reports are reviewed where available.

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

Figure 12: Exposure Index Calculation Formula
DATA ASSESSMENT

The National Asbestos Medical Panel reviews the information obtained, calculates an exposure index (see overleaf) and correlates 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 three-point grading (C).

Guidelines for calculating this index are shown as follows:

\[
\begin{align*}
A &= \text{Total years of exposure in any one job} \\
B &= \text{Job intensity as follows:} \\
    &= \text{Mining, milling and processing} = 5 \\
    &= \text{Boiler/lagging, rail carriages, shipyard, spraying insulation} = 4 \\
    &= \text{Asbestos cement products, construction, demolition, removal} = 3 \\
    &= \text{Electrical, friction products} = 2 \\
    &= \text{Loading, driving, environmental} = 1 \\
C &= \text{Degree of exposure (unprotected) } \\
    &= \text{Continuous (>50% of work)} = 3 \\
    &= \text{Intermittent (20-50% of work)} = 2 \\
    &= \text{Minimal (<20% or occasional)} = 1 \\
D &= A \times B \times C \text{ for each job Exposure index} \\
   &= \text{sum of all Ds}
\end{align*}
\]

MEDICAL DATA

Relevant respiratory symptoms and signs are recorded from the medical histories, and lung function data is classified into restrictive, obstructive, mixed or normal. Pathology reports are 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.
APPENDIX 3

PUBLICATIONS ON ASBESTOS


National Asbestos Registers, Annual Reports:

|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|


OUT-OF-PRINT PUBLICATIONS (LIMITED AVAILABILITY)


Asbestos: A Deadly Dust. 50 Years of Asbestos Use in New Zealand. Reprint from Safeguard magazine, December 1991.
