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PART 1.0 INTRODUCTION

1.10 Background

The mention of "Wittenoom" brings a diversity of reaction to many people because of the considerable number of mine and mill workers as well as residents who have died from asbestos related diseases. Wittenoom is the given name to a town in the Hamersley Ranges but the Wittenoom area consisted of 3 separate mining stages and areas and 2 separate residential sites that existed over some 30 years and covered an area of 400 sq km. The mines and towns have been subject to considerable inspection by the authorities during the mining and post mining eras.

One could reasonably ask why such concern about an isolated township and defunct mine that ceased in 1966. The answer lies partly in the following:

(i) due to latency effects we are currently observing the peak of cases of mesothelioma and lung cancer due to exposure in the 1950's and 1960's;

(ii) there has been an inadequate response to compensation claims made by former workers and residents;

(iii) there was in the past a considerable lack of technical data on which to make predictions;

(iv) there has been considerable public, media and political pressure on the subject.

The announced closure of Wittenoom in 1978 by the State Government was essentially a result of continued recommendations of the Public Health Department of Western Australia. Many Pilbara and Wittenoom residents strongly opposed the closure of the town. They believed the health risk from asbestos to be much lower than the risk during the mines' operation. They believed tailings within the town should be removed to further lower the risk to residents. Pressure from the residents resulted in a review of government policy and in 1984, the State Government modified the policy to allow the town to wind down gradually. No one was forced to leave. Compensation was offered to those who chose to depart. Since then the people of Wittenoom through the Health and Works Committee have worked with the Government but increasingly felt powerless as essential and other services like Police and medical services were withdrawn.

In recent years Wittenoom residents have sought an independent inquiry into government policy towards the town. The independent inquiry would exclude state public servants, particularly those responsible for developing policies which had led to the winding down of the town and its services.

The people of Wittenoom negotiated a commitment from the Premier about September 1991 for an independent inquiry and requested that the Hon Mark Nevill MLC, Member for Mining and Pastoral Region chair the inquiry.

1.11 Terms of Reference

Early in 1992 Cabinet agreed to a committee of inquiry to report to the Premier Hon Carmen Lawrence MLA. The terms of reference for the inquiry were to examine and report on:

- problems associated with asbestos contamination at Wittenoom, and
- what action, if any, is required to stabilise or dispose of asbestos tailings in the Wittenoom district to protect and promote the health and welfare of Wittenoom residents and visitors.

Appendix 1. provides a chronology of significant events relating to the Wittenoom issue.

1.12 Members of the Inquiry

The Hon Mark Nevill MLC lived in Wittenoom in 1980-1981 while employed as a senior geologist for Western Mining Corporation. He has a close interest in matters associated with asbestos mineralogy, asbestos contamination and associated health risks. Mr Nevill has been a Member of the Legislative Council since 1983 and chaired several inquiries as Chairman of the Legislative Council's Standing Committee on Government Agencies from 1986 to 1989.

Mr Alan Rogers is an occupational hygienist and senior lecturer with Worksafe Australia. He is a recognised expert on asbestos issues and has undertaken international consultancies on asbestos problems and authored many technical papers including research on Wittenoom.

Mr John Enfield AO, the Chief Executive of the Institute of Engineers was the other member of the committee. He was a former Commonwealth Public Service Commissioner who completed an independent review of current practices and procedures for the handling of asbestos in Department of Defence establishments. That report was tabled in the Commonwealth Parliament in March 1991.

Ill health prevented Mr Enfield from visiting Wittenoom on the two field trips. He was involved in the consideration of evidence but passed away in August 1992 whilst the draft report was being considered.

The inquiry was assisted by its research officer Mr John Reed a PhD student from the Institute for Science and Technology Policy at Murdoch University.

1.13 Report Time Frame

The inquiry was announced by press release and two press advertisements in The West Australian on 8 February 1992 and in the North-West Telegraph on 12 February 1992.

The report was to be completed by 30 May 1992 but was delayed because of the difficulty of obtaining raw data necessary to reach conclusions.

1.14 Submissions Received

Twenty eight submissions were received from individuals, government and private organisations and are listed in Appendix 2.

1.15 Visits to Wittenoom

The committee made two visits to Wittenoom. On its first visit on Wednesday 22nd and Thursday 23rd April 1992 the Committee inspected Yampire Gorge Mine, Wittenoom Mine, Colonial Mine and mill, Eastern Gorge tailing dumps and the Settlement. It also undertook a series of inspection traverses across the town, the race course and the airport (Figures 1 and 2). Evidence was taken from residents and the Ashburton Shire Council. The committee took still photos and six hours of video taping during this visit to record current conditions in the area of inspection. The videotape was edited down to two and a half hours.

On its second visit on Tuesday 19th and Wednesday 20th May 1992, the committee undertook airborne dust sampling and revisited the Colonial Mine, mill and tailings dumps and inspected Joffre Creek near where the Wittenoom - Tom Price Road crosses it 3 kilometres west of Wittenoom. It also undertook a further inspection of the town and Settlement and inspected the head of Western Creek Gorge and Colonial Gorge above the mine. The committee undertook further video taping on this visit.

1.20 State Government Policy

Over a number of years Inspectors from the WA Public Health Department had raised concerns regarding the use of tailings throughout the township and Settlement and the possible health consequences to the residents.

In November 1978 the State Government announced the decision to phase out Wittenoom following the publication of the Public Health Department booklet "The Health Hazard of Wittenoom".

In August 1979 the State Government agreed to help assess the health risk at Wittenoom and work towards reducing that risk in the town. The Wittenoom Works and Health Committee was formed to develop a strategy. Membership comprised 8 elected residents and one nominee from the Public Health Department, the Department of the North West and the West Pilbara Shire Council (now the Ashburton Shire Council).

In December 1980 the State Government banned connection of power and water to houses of new residents arriving in Wittenoom.

After a major review the Government adopted in October 1984 a policy of phasing down activity in Wittenoom by proposing residents relocate and offering to purchase their houses, businesses or other property. The government would treat Wittenoom the same as other small towns in the State but power and water supplies would not be reconnected to disconnected properties nor connected to new buildings.

Under this 1984 policy, if a business, such as a garage or motel, was acquired it was kept operating until alternative services were available in Wittenoom or nearby to service residents and visitors to the Karijini (Hamersley Range) National Park.

Since 1984 the State Government has spent over $1m purchasing and demolishing houses and buildings. It bought the Fortescue Hotel which remains open under limited lease.

The Wittenoom Primary School, the nursing post and the police station were closed between 1985 and 1990. Some 51 houses and buildings were demolished in 1987 and 1988.

Further pressure on the town's residents was exerted in 1989. The Commissioner for Occupational Health, Safety and Welfare wrote to Commonwealth and State Government departments and agencies and to private employers whose employees worked at or visited Wittenoom giving his view of employers' legal obligation to provide a safe working environment for employees.

PART 2.0 THE TOWN AND SURROUNDING ISSUES

2.01 Air Monitoring before 1967

Occupational air monitoring to determine the level of airborne asbestos fibres was undertaken from 1951-1966 at both the Wittenoom Mine and the Colonial Mine by Mines Department Officers, employees of Australian Blue Asbestos Ltd and by Mr Gersh Major of the Occupational Health Unit of the School of Public Health and Tropical Medicine at the University of Sydney. Although the data collected with historical dust sampling instruments is not directly comparable with modern asbestos sampling, the results indicated excessive occupational exposure particularly in the mill.

Prior to the mines closure in 1966 there is no record of environmental air monitoring at either the Settlement or at Wittenoom. Since 1966 a series of environmental air monitoring programs have been attempted with varying degrees of success.

2.10 EXPOSURE TO CROCIDOLITE FIBRES AT WITTENOOM

2.11 Why Airborne Assessment?

Asbestos exerts its toxic effects after it has been inhaled. In many occupational situations the risk of acquiring an asbestos related disease is associated with the duration of exposure multiplied by the concentration of asbestos fibres in the air. Health authorities set exposure limits by assuming a lifetime of working in an asbestos industry and then set the lifetime average numbers of fibres permitted in the factory or mine air (expressed as fibres/cc of air). Air monitoring which measures the number of fibres found in the air can then be carried out to determine if a particular premises or mine exceeds the standard and hence if it requires upgraded control strategies.

In asbestos mining and processing industries the amount of fibres found in the air is generally related to the quantities of fibre handled and the degree of disturbance it undergoes during the processing. Fibres are mostly released direct from the machinery or from bulk asbestos.

In environments like Wittenoom airborne fibres are generated differently. When mining, milling and dumping of tailings was underway, fibres were released direct to the atmosphere and polluted some of the Gorge areas. Once the surfaces of tailings piles have been partly stabilised by weathering, the natural actions of wind and water do not result in the release of measurable airborne concentrations of fibres partly due to the fact that the fibre bundles are too large to become airborne. The more important mechanism of airborne generation at Wittenoom has been by secondary disturbance. Activities such as human (walking, playing or digging in tailings), animal or motor vehicle (driving on road tailings) disturb the surface and break down the large fibre bundles into fine respirable size fibres (less than 3 micrometres in diameter) which are then more easily released as airborne fibres by current or future activities.

It is relatively easy to measure airborne fibres being released from industrial and mining processes. It is difficult however to obtain reasonable estimates of the level of exposure resulting from the range of environmental and residential activities that have occurred or are likely to occur at Wittenoom because of the diversity of those activities.

Before assessing the potential environmental exposures at Wittenoom it is necessary to review the monitoring methods and their relevant exposure standards.

2.12 Methods of Measurement

Occupational - The measurement method used in most industrial countries is known as the "membrane filter method" (MFM). In Australia the only recognised method for regulatory purposes is the Worksafe "Membrane Filter Method for Estimating Airborne Asbestos Dust" (1988). In summary, dust is captured by using a small battery operated pump attached to the worker to draw a known volume of contaminated air through a filter cassette containing a thin membrane filter . At the completion of sampling the filter is taken to a laboratory and chemically treated to make it transparent. The dust on the cleared filter is then scanned under a phase contrast light microscope and the particles that are thought to be asbestos fibres (but may not be asbestos) are counted and reported as fibres per cubic centimetre of air. Not all asbestos or non-asbestos fibres are counted, only those with an aspect ratio of length to width of 3:1. In addition, the fibres must be greater than 5 micrometres in length and less than 3 micrometres in width ("regulatory" fibres). Fibres with diameters of less than about 0.2 µm are not observed because of the restricted resolving power of the light microscope. The size selection of these "regulatory" fibres is based on knowledge derived from epidemiological studies of the size of fibres which are most likely to penetrate to the lung and also likely to cause disease.

The MFM was developed for measuring worker exposure in asbestos industries where the predominant fibre type is asbestos. Since measurements are made in the trace analytical range, considerable skill and diligence is required by the counter. Even then the accepted analytical error is of the order +/- 30-40%. In situations where other fibres or dusts predominate (such as paper dust in offices or mineral fragments in mines) the method gives false high readings and the analytical error usually exceeds +/- 100%. To minimise reporting errors it is necessary to confine the field sampling and counting method to set sampling parameters so as to achieve reasonable accuracy and precision. For these reasons it is generally accepted that the MFM does not provide a reasonable method of assessment of low level asbestos exposure in situations such as office buildings, non asbestos mines and the general environment.

Environmental - Asbestos in the general environment consists of short fibres which are found at very low concentrations and are only a small component of the total airborne dust. As such high volume sampling with analytical methods which are specific to asbestos in trace quantities are required. In general, the principles of sampling the air are similar to occupational sampling i.e. drawing the air through a membrane filter and subsequent preparation and analysis of the asbestos content.

Analytical Transmission Electron Microscopy (TEM) methods allow high magnification of the filter and hence the ability to view each fibre. In addition it is possible to focus the electron beam on even the smallest fibres and obtain micro-chemical identification (EDAX) and micro-crystal structure analysis (SAED). This is the only method by which fibres found in the air samples can be positively identified as being asbestos or non-asbestos. All sizes of asbestos fibres with diameters less than 3 micrometres are usually reported with this method although occasionally only the "regulatory" sizes (>5 μm) are reported so as to obtain comparisons with light microscopy counts. Obtaining reliable results with this method requires considerable training, practice and skill and even then the results contain errors which are in the range of +/- 100%.

Due to the detailed laboratory preparation and the high cost of TEM work many investigators have used the less expensive and less exact Scanning Electron Microscope (SEM). However SEM methods do not allow micro-chemical analysis on the short fine fibres nor do they provide information on crystal structure. As such, SEM does not allow correct and consistent identification for asbestos content and can be considered as providing only approximate identification for the large size fibres and no certainty in small size fibres which are the type predominantly found in environmental samples.

TEM and SEM results should be examined with suspicion unless they have been provided by laboratories which have instrumentation especially designed for trace asbestos work, employ trained and experienced asbestos analysts and which can prove their performance by interlaboratory comparisons with other recognised laboratories.

2.13 Exposure Standards

Occupational- The current Australian value is based on risk assessments determined from historical asbestos industries. Allowable exposure limits depend on the asbestos type and its relevant risk of causing specific diseases.

Chrysotile (white asbestos) has been assigned an occupational exposure standard of 1.0 fibres/cc of air based on dose response data relating to asbestosis and lung cancer.

Crocidolite (blue asbestos) and ***amosite*** (brown/grey asbestos) are assigned an occupational exposure standard of 0.1 fibre/cc. The historical reason for differences between crocidolite and chrysotile was due to the potential risk of mesothelioma. The differences were not set on the basis of dose response data but rather on the basis of a technical limit using the minimum practical detection limit that could be monitored for asbestos manufacturing processes using the MFM. Historically due to difficulties in controlling dust levels to less than 0.1 fibres/cc in mining and manufacturing industries the use of a 0.1 fibre/cc standard imposed a pseudo prohibition on the use of crocidolite in Australia. Recently crocidolite has been listed by Worksafe Australia as a prohibited substance however because of its existence at locations such as Wittenoom the allowable exposure limit remains.

Environmental -

Chrysotile- In some countries ambient air standards have been set for dust emission from chrysotile mines and processing plants. In general they provide for no visible emissions. Canadian legislation sets a stack emission limit equivalent to the occupational standard based on counting fibres greater than 5 micrometres in length under the light microscope. California has a standard based on fibre measurements downwind of the plant not exceeding 10 times the total fibre count from upwind. Ontario has suggested that the occupational health standard should be reduced by 1/250th so as to apply to members of the public (ie 0.04 fibres/cc of chrysotile as determined with the light microscope).

The Ontario Royal Commission has recommended that once a suitable method of environmental measurement has been proven it should be feasible to achieve the light microscopy equivalence (fibres >5 μm) of 0.001 fibres/cc. The US Environmental Protection Agency in its school asbestos removal program has required that prior to reoccupancy that mean fibre levels inside the removal area do not exceed the mean fibre levels from the general environment outside the building.

Whilst there is considerable information regarding a dose response effect and the observation of a no measurable effect level for asbestosis and lung cancer in working populations exposed to chrysotile, no health based data or exposure standards are available for the general public. Observations made in contaminated Quebec chrysotile mining towns over the last 20 years indicate a gradual decline in fibre levels (>5 micrometres in length) to less than 0.01 fibres/cc measured under the optical microscope and by TEM. No increased mortality due to asbestos related diseases has been detected in these town residents (Siemiatychi 1982).

Crocidolite - No crocidolite environmental health standard exists in any country. Cases of environmental mesotheliomas associated with residence in crocidolite mining areas have been reported from South Africa (Cochrane and Webster 1978). No environmental monitoring data is available from this early period, however air samples taken in 1983 and 1984 in the neighbourhood of operating crocidolite mines and mills indicate levels in residential areas of 0.0002-0.0008 crocidolite fibres >5 μm measured with a SEM. Higher values were found downwind from the mines and mills and in the residences of mine workers (WHO 1986).

There is no environmental exposure standard for any type of asbestos in Australia.

2.14 Chronology and Critique of Air Monitoring at Wittenoom

There have been eight separate environmental air monitoring surveys carried out at Wittenoom in an attempt to estimate environmental and town resident exposures to residual crocidolite fibres. All of these (including the one conducted by the current Inquiry team) suffer from a number or combination of deficiencies such as being unrepresentative of the diversity of town activities, inappropriate dust capture techniques, inappropriate and inconclusive analysis techniques for fibre analysis, and reported results which are below the actual zero value of the monitoring technique used. As such it is highly unlikely that the results from these surveys can be used to form reasonable assessments of the degree or change in exposure that has occurred during the lifetime of the Wittenoom town and settlement.

A review of the sampling up until 1985 has been completed by the WA Government Chemical Laboratories (Clarke 1986) and we would in general agree with Clarke's critique of the deficiencies in such sampling, analytical methods and reporting practices. The results of the eight surveys are presented here without further comment.

1. *July 1977 - Public Health Department Report*

This comprises a number of air sampling exercises. The first involved personal and fixed area samples obtained in 1973 but which were not analysed until 1975. The authors indicated that the sampling was considered to be unsatisfactory. In July 1977 mean values of 1.8 fibres/cc were reported whilst driving around the town with the sampling head protruding from the boot of a car. No asbestos fibres were found in static samples taken at the local service station. in November 1977 a single personal sampler worn by a mines inspector in the town produced a result of 0.2 fibres/cc. In July 1978 person samples worn by town residents produced values of 0.01-0.21 fibres/cc with a mean of 0.08 fibres/cc.

2. *September 1978 - Public Health Department Survey*

127 person air samples were collected on town residents and local workers. Seventy were considered suitable for analysis and results ranged from less than 0.01-0.14 with a mean of 0.03 fibres/cc. The higher values were found in occupations which involved disturbance of tailings and roads or from those whose main job that day involved in driving around the area.

3. *October 1980 - Public Health Department Survey of the School*

Static air samples using a newly designed and essentially untested vertical elutriator were collected from a fixed secure location in the primary school playground. (These vertical elutriators are similar to those used for cotton dust sampling in the USA and have been extensively criticised for their deficiencies in collection efficiency). A twenty four hour sampling sequence was used on a rotating 6 day basis. Counting was carried out by newly trained personnel from the Clean Air Section of the Department who used value judgements to determine if the fibres observed were asbestos or not. In some instances the results were reported to a lower level than was achievable from the method. Some of the filters were examined in the UK under TEM (for all fibre sizes) which revealed that most were not crocidolite. Almost all the results were less than 0.015 fibres/cc and for the 12 months of sampling in 1984/85 the results reported were less than 0.002 fibres/cc.

4. *1985 - Wittenoom Environmental Engineering Study*

This study was commissioned via the Geraldton Building Company to obtain information on sites of contamination (a somewhat false assumption). Battery operated vertical elutriator static sampling was collected over 24 hours at sites in and around the town. Rapid counting of samples was performed by a commercial laboratory and results were reported to levels well below those recommended in the MFM. Results indicated that 93.5 % of the useable samples were less than the reported detection limit of 0.0007 fibres/cc. The highest mean value of 0.013 fibres/cc was recorded at the mine site.

5. *1986 - WA Department of Conservation and Environment Survey*

A more extensive survey was carried out to determine the influence of various meteorological conditions. Vertical elutriators were again used. Persons doing the microscopic counting were not occupational hygienists experienced in asbestos analysis yet they made decisions as to the likelihood that the fibres they counted were or were not asbestos. Although the report produces many pages of calculated results in reality, the majority were less than the detection limit (0.007 fibres/cc) and hence cannot be distinguished from zero. In fact in the areas of highest contamination and activity only a small proportion of results were above the detection limit of the sampling method. Of the 81 samples collected from the school only 3 were at 0.0007 fibres/cc. From 84 samples collected from the airport 31 were above the detection limit but for 10 consecutive days the results were excessively high and this could not be explained by abnormal wind conditions indicating unusual physical disturbance of the site. One of the heavily contaminated town sites produced 31 out of 83 results over the detection limit but these were not related to wind or rain conditions. At the police station 8 out of 83 samples exceeded the detection limit. SEM analysis of some filters failed to identify crocidolite although this was more likely due to resolution limit imposed by the SEM detector used in the analysis. Not surprisingly (because almost all of the results were below the detection limit and hence no different to zero) the investigators found that the results were not effected by meteorological conditions such as wind or rain.

6. *February 1990 - Shire of Ashburton Survey*

Static monitoring using modified NOHSC paraoccupational sampling techniques was carried out around the town. Eighteen of the 332 samples exceeded the detection limit (0.001 fibres/cc) with the highest being 0.003 fibres/cc. SEM analysis was attempted on approximately 10% of the samples. Although most fibres were determined not to be asbestos, the results should be considered to be inconclusive due to resolution problems with the SEM detector.

7. *March 1990 - Shire of Ashburton Survey*

Personal samples were obtained on Shire Council employees working at Wittenoom. Of the 32 samples taken 22 were less than 0.01 fibres/cc, 8 were at 0.01 fibres/cc and 2 were 0.02 fibres/cc. The higher values were found during lawn mowing. SEM analysis was carried out on some of the samples and although many of the fibres were reported as not being crocidolite, the results should be considered to be inconclusive due to resolution problems with the SEM detector.

Overall, up until 1991, at best the surveys have been conducted by groups of enthusiastic air monitoring amateurs who had little idea of the problems in conducting and analysing realistic environmental air sampling programs for determining trace asbestos levels. However, the results obtained could be expected i.e. airborne levels of crocidolite were very low and well below the level which normal air monitoring techniques can determine.

8. *May 1992 - NIOHS / Wittenoom Inquiry Survey*

A combination of personal and static air samples were taken by the inquiry team and later analysed by TEM at the National Institute of Occupational Health Laboratories in Sydney. The results are shown in the following table. The reason for the additional monitoring was that all the previous surveys suffered from poor or inconclusive analysis of the fibres collected on the filters. In addition the purpose of the survey was to determine the general airborne concentrations in the township, exposure to resident workers and exposure to tourists walking around the mine site and over the tailings areas and to use this survey to calculate health risks for various groups.

WITTENOOM INQUIRY AIR SAMPLING (MAY, 1992.)

All analysis carried out by NATA registered method NIOHS/TEM/MFM1-MFM2 which uses TEM with EDAX and SAED where necessary for all lengths, >3:1 fibres with D<3 µm. MFM equivalence is obtained by considering only those fibres which would be observed under PCM (Phase Contrast Microscopy) and conform to the MFM counting procedure (>5 µm L, >0.2 µm D)

LOCATION/TEM COUNTS TYPE	CUMULATIVE SAMPLING TIME	EQUIVALENT MFM COUNTS CROCIDOLITE	
Fibres/cc all size Crocidolite	Minutes	Fibres/cc Total	Fibres/cc >5 µm L
92-136 Personal/worn by inspection team, walking over tailings, mine and mill	840	0.014	0.010
92-137 Personal/worn by assistant in town store	785	<0.003*	<0.003
92-138 Static sampler outside Hotel	1130	<0.002	<0.002
92-139 Static sampler Settlement road	1170	<0.002	<0.002
92-140 Static sampler Store Car Park	903	<0.002	<0.002
92-141 Static sampler outside Workshop at Colonial Mill	1274	<0.002	<0.002
92-142 Field Blank	no fibres detected		

Note: < "less than" values indicate no asbestos fibres were detected in the analysis unless otherwise stated. The result is calculated based upon the detection limit of a minimum four fibres according to the theoretical (Poisson) distribution.

* No fibres >5 µm were found however two crocidolite fibres measuring <2 µm in length and 0.2 µm in diameter and <1 µm in length and 0.1 µm in diameter and one half crocidolite fibre measuring <5 µm in length and 0.3 µm in diameter were found in the sample.

2.15 Future Air Monitoring Requirements and Environmental Standards

It is estimated that the cost of the combined environmental air surveys at Wittenoom has exceeded $100,000 and it is rather disappointing that due to the technical deficiencies referred to above that there is little information to be gleaned from the data. At best they indicate that airborne concentration at Wittenoom has decreased from levels which would have been readily detected

by standard MFM sampling techniques down to the present levels which are below the detection limit of sophisticated TEM techniques. Any measurable fibre concentration has been associated with human activities which disturb tailings. On the available data there are no measurable levels of airborne fibres being released from tailings dumps or from roads that had been previously made from tailings. This undoubtedly is due to the extensive program of clean ups in the town.

Under existing conditions it would appear that further air monitoring would not provide any additional information except to confirm that the exposures would be very low. Should there be a major disturbance such as clean-up of tailings in the town or mine areas then it will be necessary to conduct a well supervised and technically competent air monitoring program to ensure protection of the workers and residents and adherence to correct control procedures.

In reviewing any air monitoring results there is a tendency to want to compare them against some arbitrary or health based standard. No such environmental standard exists in Australia however the Committee has been asked in a number of submissions to recommend a suitable environmental exposure limit for Wittenoom.

If indeed there was some basis on which to set a standard then it would be required by some that regular monitoring be carried out to ensure compliance. Due to the very low levels of fibres detected in the samples the only methodology which would produce meaningful results is high volume sampling with TEM analysis which is carried out according to proven methodology. The continued cost of such sampling ($500 per sample plus site supervision) is not justified by the data that would be provided by the results.

No reasonable health based decisions could be made with the results obtained. Determining an exposure limit would require assumption of risk data being extrapolated well below existing knowledge. The resultant relative risk that would be acceptable to most of society would be at or below the levels of non asbestos risks that already exist at Wittenoom. These comparative risks are included in the chapter on Health Issues.

Having considered the points discussed above we are of the opinion that there is no reason to set or any benefit in setting an environmental asbestos standard for Wittenoom.

2.20 THE HEALTH ISSUE AT WITTENOOM

2.21 Asbestos and Health

Many thousands of reports in the scientific and medical literature indicate that occupational exposure to asbestos minerals (such as crocidolite) result in the development of asbestos related diseases such as asbestosis, lung cancer and mesothelioma. Most of the problems that have occurred are due to extremely high exposures in the past that have resulted from uncontrolled work places. The scientific evidence often appears confusing and contradictory. This is because of the complexity of the overall picture of asbestos and disease, the toxicological differences in asbestos types, exposure conditions and the resulting type of disease. There are however a number of consistent findings including:

- the different asbestos types have a different potential to cause different types of disease
- the risk of acquiring each type of disease is dose related i.e. the higher the concentration of dust and the longer the exposure the greater the chance of developing the disease.
- there is a long latency period between initial contact with asbestos and the development of disease.

Detailed knowledge on each of these aspects enables us to determine specific risk levels for a given exposure, to set reasonable occupational exposure standards and to predict future cases of disease that will result from past exposure.

2.22 Asbestos Diseases found in Wittenoom Workers

Asbestosis

This is a disease specific to asbestos and essentially is fibrosis (scarring) of the gas exchange sacs inside the lung. It is usually associated with heavy exposure to asbestos dust and is observed within a few years of such exposure with severity of progression dependent on the level of subsequent exposure. For occupational exposure at Wittenoom some 356 cases of compensable asbestosis have been detected and the incidence has been found to be related to the duration and intensity of crocidolite dust exposure and was greater in the mine than the mill workers (de Klerk 1989, Musk 1991). No cases have been reported for the townspeople or children. International evidence suggests that a threshold of exposure around 25 fibres/cc years is necessary before asbestosis is observed.

Lung Cancer

This is a an abnormal new growth of tissue (tumour) in the lower respiratory tract (bronchi, bronchioles and pulmonary parenchyma). It is a common disease in the Australian population and is the cause of death of 1 in every 14 males and 1 in every 63 females. Approximately 85% of lung cancers have been attributed to cigarette smoking. Elevated risk of lung cancer has been reported in asbestos workers particularly those who have been heavily exposed and who are also cigarette smokers. To 1986 there were 141 lung cancer cases in the Wittenoom miners and millers which is 36% higher than would be expected in the normal population. Due to latency effects, excess lung cancers will continue to be observed in the Wittenoom workers (Berry 1991). It is impossible to distinguish between lung cancers caused by smoking or other environmental factors and those caused by asbestos.

Mesothelioma

This is a rare tumour which develops mostly on the outside lining of the lung. About 350 cases occur in Australia each year (approximately 10 of these are due to Wittenoom exposure). Between 65 to 75% of the Australian cases have been employed in industries using asbestos and exposure to crocidolite is the most potent industrial agent for causing the mesotheliomas. Time from first exposure to asbestos and the development of the disease (mean latency) is around 35 years (range 20-50 years). Up to 1986, 94 cases had been reported from former mine and mill workers.

2.23 Asbestos Diseases in past town people and visitors to Wittenoom

There has been no published data on the extent of asbestos related disease in those people who lived and visited Wittenoom but who were not employed at Australian Blue Asbestos. Some evidence was presented to the inquiry of specific case lists of mesothelioma but it was impossible to obtain sufficient details on these to allow further analysis. In addition upon closer examination of the files, it was found that some individuals' whose cases had been reported in the media as being environmentally acquired had in fact been also employed at the minesite.

Due to the low levels of airborne fibres in the township compared with manufacturing processes it would not be expected that clinically significant asbestosis would be found in this population. Experience from the mine and mill workers indicate that although lung cancer is common, a considerable amount of exposure is required before excess lung cancers are observed.

Given the confounding and overriding influence of tobacco smoking on lung cancer risk it is impossible to use it as an indicator of asbestos disease risk in the Wittenoom community. The rarity of mesothelioma in non-asbestos exposed persons provides a clearer analysis.

From the Worksafe national data base of 3,292 mesothelioma cases collected between 1979 and May 1992, it was determined that 144 had some contact with Wittenoom. Examination of the occupational and environmental histories indicated that most of the cases arose out of direct occupational contact at the mine and mill, but there were also cases found in women, children and town visitors (see following Table).

Using the latency method for predicting the total expected mesotheliomas (Rogers 1992) it can be calculated that 0.6% of the persons who were child residents and 1.2% of adult female residents at Wittenoom will die or have died of mesothelioma. This compares to 6.9% of the workforce employed at the mine and mill.

The mortality rate for women and children would appear disproportionately high compared to those employed at the mine and mill who were exposed to very high levels of fibres. These higher rates are probably due to a combination of factors such as longer residency at Wittenoom or the Settlement (Hansen 1992) with its subsequent increase in cumulative exposure. In addition other factors such as secondary sources of exposure from washing spouses' clothing and playing in tailings, or child susceptibility may distort the differences.

To examine the importance of the difference in the residence duration between the mine working population and that of the township, incidence rates as population-time were calculated using the duration data of Armstrong et al (1988) and Hansen et al (1992).

Comparative mesothelioma rates were as follows:

77.4 per person 1,000 years for employees at the minesite

3.6 per person 1,000 years for residential adult females

1.7 per person 1,000 years for residential children

Differences in risk between residential location can be observed from the fact that for the 5 female environmental mesotheliomas 2 were known to come from the Settlement (with one later moving to the town) and 3 lived in the town; for the 7 children, 1 was from the Settlement and 6 lived in the town. It is difficult to compare mesothelioma risk between the Settlement and town as there are no site population estimates.

However examination of historical aerial photographs from the 1960's indicates between 12-15 houses were at the Settlement and approximately 150 houses in the township. If the relative house numbers were reflected in relative population numbers, then the following incidence data can be calculated:

Settlement (1 kilometre from the mine)

14.2 per person thousand years for adult females

2.4 per person thousand years for children

Town (8 kilometres from the mine)

2.4 per person thousand years for adult females

1.6 per person thousand years for children

The increased risk of mesothelioma at the Settlement probably reflects airborne exposure arising from the nearby mill (~1 Km) and the dumping of considerable quantities of tailings in Eastern Gorge, the Magazine area (~500m), Colonial Gorge and the Market Garden (~1 Km).

Even though the residential areas of the town and Settlement were grossly contaminated with tailings, exposures would have been much less than in the mine or mill. One method of comparing these different exposures would be to examine the crocidolite concentrations found in the lung tissue. It has been previously reported that lung crocidolite fibre burdens from Wittenoom workers have been found to relate linearly to duration and intensity of exposure (Rogers et al 1991). However in the Wittenoom series, only one purely environmentally exposed lung sample was available for analysis. This was from a child who resided in the settlement for 48 months in the late 1940's and who later died of mesothelioma. The crocidolite lung content in the ex child's lung was equivalent to that of a miller with 0.4 weeks contact or 6.6 weeks as a miner.

The difference between the mesothelioma rates for occupational versus environmental groups are still not large enough to account for the large differences between airborne exposures in the mine, mill and the township. The evidence tends to indicate that cumulative exposure is not necessarily the best indication of risk at Wittenoom.

2.24 Future Environmental Cases of Mesothelioma

Occupational and environmentally induced lung cancer and mesothelioma will continue to be observed in the future partly as a result of latency effects from past exposures during the operation of the mine, partly from contamination of the township by the continued use of tailings up until the late 1970's and partly due to future contact with the residual contamination of the township, Settlement and mine site. The relative effects are explored below.

Cases due to latency effects from 1940's-1960's

The predicted number of cases of mesothelioma due to latency effects (20-45 years) from the mining operation phase are listed in the attached table and diagram. Some 291 future mesothelioma cases are expected till the year 2020. Nineteen of these are from past environmental exposure and consist of 5 adult females, four children and ten visitors. The clinical trials using Vitamin A may effect these predictions.

Cases due to environmental exposure 1966-1992

Due to the relatively short time since exposure, it is impossible using proportional latency calculations to estimate future cases of mesothelioma. However since the cumulative town population during this period was around 40% of the total (~2000), the use of tailings ceased and there was a considerable program of tailings clean-up in the town areas with subsequent reduced airborne exposures to less than 1% of 1966 values. Assuming linearity it could be expected that much less than 1 environmental case of mesothelioma (51 from estimates table x 0.4 x 0.01) would occur from the town population 1967-1990. This is equivalent to 10 cases per million population for the 25 year contact period and is similar to the estimates provided by other researchers using airborne fibre levels to estimate 57 cases per million population for a 10 year childhood exposure at Wittenoom. (de Klerk and Armstrong 1992).

Cases due to environmental exposure post 1992

Due to the continuation of tailings clean-up in the township it could be expected that the risk to the 45 residents would be less than for the period 1966-92 listed above. Some 40,000 tourists visit the Wittenoom Gorge and surrounding National Park. Using the May 1992 TEM airborne exposure values, the following risk estimates were kindly calculated by Dr N de Klerk of the University of Western Australia;

FUTURE RISK TO TOWN RESIDENTS (based on 0.001 fibre/cc)		
	1 Year Residence	10 Year Residence
Child (age 6)	7.32	56.7
Adult (age 21)	2.80	20.3
FUTURE RISK TO TOWN VISITORS (based on 0.001 fibre/cc)		
	1 Week Visit	1 Month Visit
Child (age 6)	0.14	0.56
Adult (age 21)	0.06	0.24
FUTURE RISK TO VISITORS OF MINE SITE ENVIRONS (based on 0.01 fibre/cc)		
	1 Day Visit	1 Week Visit
Child (age 6)	0.20	1.4
Adult (age 21)	0.09	0.6

(upper estimates expressed as lifetime risk of developing mesothelioma per million persons, based on an average exposure of less than 0.001 fibres/cc in township and 0.01 fibres/cc walking around on minesite tailings)

In comparison a lifetime rate of 260 mesotheliomas per million persons (4.4/million/year) is observed in the Australian population where there is no significant occupational or environmental exposure to asbestos (Leigh et al 1991).

Non-asbestos risks also exist for tourists visiting the area. The following risks are based on Government records indicating an annual average of 35,000 tourist visitors, 4 deaths due to falls in the Gorges recorded since the opening of the National Park in 1969 (1976,86,87,90) and 2 fatalities and 14 serious injuries on the roads surrounding the National Park during June 1985 - March 1992.

NON-ASBESTOS RISKS FOR VISITORS TO WITTENOOM	
3.2	deaths per million from falls in the Gorges
0.5	deaths per million from car accidents on the roads surrounding the National Park.
3.4	serious injuries per million from car accidents on the roads surrounding the National Park.

In summary the numeric risks calculated in this chapter can be placed in a hierarchy of relative risk compared to the non-asbestos mesothelioma rate found in the Australian population.

RELATIVE RISK OF MESOTHELIOMA OR OTHER CAUSES	
1.0	mesothelioma in the normal unexposed Australian population
1.0004	1 week visit to Wittenoom town post 1992
1.002	tourist road deaths Wittenoom area
1.003	1 week visit to Wittenoom mine site post 1992
1.012	tourist deaths from Gorge falls in National Park, Wittenoom area
1.013	serious injuries to tourists from motor vehicle accidents, Wittenoom area
1.08	child 10 year resident at Wittenoom post 1992
1.23	adult 10 year resident at Wittenoom post 1992
22.0	child resident in Wittenoom pre 1970
46.0	adult female resident in Wittenoom pre 1970
265	miners and millers employed at Wittenoom pre 1966

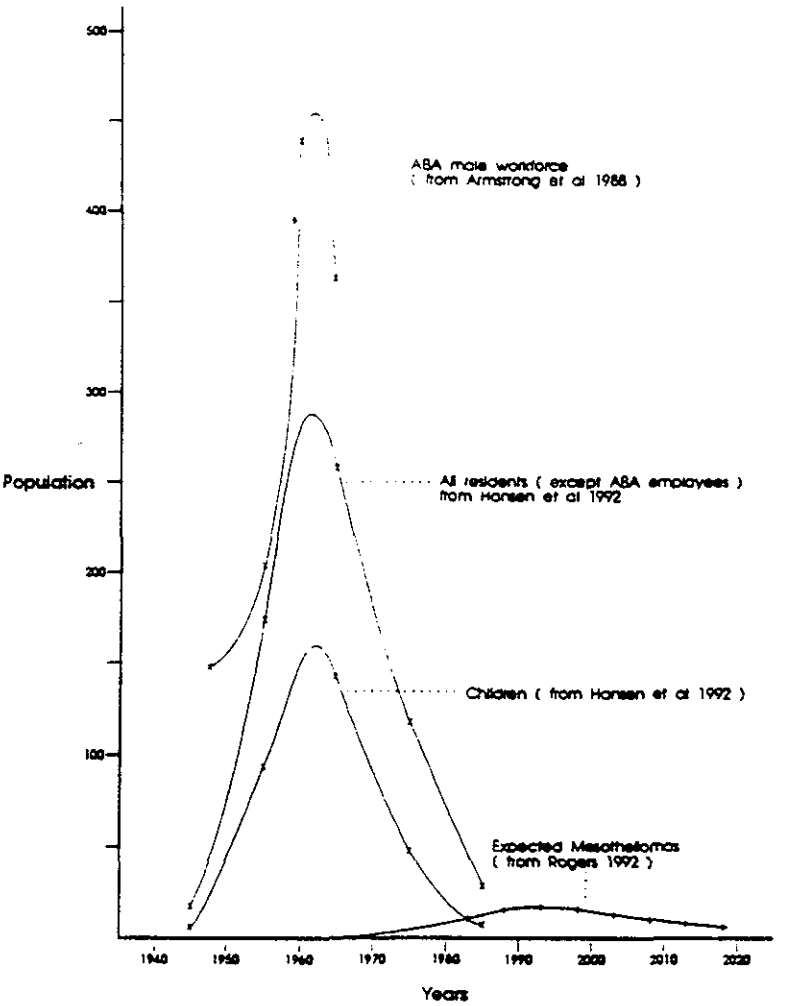
ESTIMATES OF OCCUPATIONAL AND ENVIRONMENTAL MESOTHELIOMAS FROM WITTENOOM DERIVED FROM PROPORTIONAL LATENCY CALCULATIONS (after Rogers 1992)

Group	Total Cases	Estim. Population	PRE 1979 Cases	1979-92 Cases	POST 1992 Cases
Occupational at Mine Site					
Mill and Mine	447	6502#	77	104	266
Other Occupational, worked with Fibre or Tailings					
Truck Drivers to Point Samson	8		1	4	3
Wharf Labourers Point Samson	4		0	2	2
Road maintenance using tailing	7		2	4	1
Unknown Date/Location	6			6	
	25		3	16	6
Environmental					
Town people - females	14	1178~	4	5	5
Children	14	2450~	3	7	4
Visitors (town + mine)	20		3	7	10
Unknown	3			3	
	51		10	22	19
Unknown (Adults occupational/environmental ?)	2			2	
	525		90	144	291

de Klerk (1989) ~ Hansen et al (1992

Population Distribution - ABA Employees, Town Residents and Mesothelioma Cases

(mid point plot)



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2.30 The Town

2.31 Residential History

Prior to 1947, workers at the Yampire Mine lived on site. Staff and workers of the Wittenoom Mine lived at the Settlement.

The building of Wittenoom started in 1947 to house workers and their families. Senior staff and families were housed in the Settlement, which is where Wittenoom Gorge meets Eastern Gorge (Figure 2) about one kilometre downstream from the Wittenoom Mine. Ironically, this privileged and scenic place was affected more by the dust from the mill than was the town of Wittenoom which was 10 kilometres away further down the Gorge (Figure 1).

In the 1950's, Wittenoom was the largest town in Western Australia north of the Tropic of Capricorn. By 1953 there were 152 cottages, a general store, cafe, cinema, billiard room, hotel, tennis courts, race-course, cricket and football grounds, post office, police station, hospital and school. Single men were accommodated in two roomed huts, four men to each hut. A central cafeteria was provided for their use (ABA Report 1953).

The town grew until the early 1960's, when the mining operation was at its peak. The closure of the mine in December 1966 caused an exodus, but after this setback the population rose again until 1978, when the State Government decided to phase out the town in response to advice from the Public Health Department (see section 1.2).

A general store and fuel outlet, tourist shop, shire office, three backpackers hostels, a hotel and a caravan park currently remain open. The Fortescue Hotel is owned by the State Government and is administered by the Department of State Development.

2.32 Distribution of Tailings

Throughout the lifetime of the town, tailings containing crocidolite were spread around the town by private individuals, cartage contractors, Commonwealth and State Government departments and the local Shire (the Tablelands Shire Council at the time). Attempts to get specific records of the amount of tailings which were deposited in the town prior to 1970 were unsuccessful. An estimated 60,000 - 80,000 tonnes of tailings were used in the upgrading of the airport during 1959 and 1960. Tailings are mixed with soil to a depth of about one metre. The airport was an important link in MMA services to the Kimberley and the Northern Territory up to 1966. No tailings were dumped at the old rubbish tip but an estimated 600 tonnes of tailings were used on the "greens" of the 18 hole golf course between the race course and the old rubbish tip.

2.33 Clean Up of Tailings

The following is a brief outline of the clean up the town, to reduce the level of airborne asbestos fibres. The work undertaken by the State Government had the primary aim of closing down services in the town. Prior to 1980 there were no significant attempts to clean up tailings in the town.

1980 Hancock & Wright	Demolition of 13 houses
1980 - 1981 Shire of Ashburton	Cul-de-sac termination bulbs were constructed and some tailings were removed from road reserves and laneways. Tailings were removed from an area east of the town where they had been previously dumped.
1981-1982 Shire of Ashburton	The 1981-1982 clean up included sealing the cul-de-sac bulbs, widening, kerbing and resealing approximately half the town streets, and removing tailings from road reserves and laneways to produce a "clean" area.
1982	Tailings from Catholic Church grounds, including the convent and school removed, except for tailings too close to buildings for heavy machinery to operate.
1982-1983 Shire of Ashburton	Kerbing and sealing of the town streets completed.
1985 Hancock and Wright	Demolition of 60 houses, buried on site and covered with clean soil.
1986-1987	Wittenoom-Wittenoom Gorge Settlement road re-sealed (9 kilometres).
1987 May State Government	Demolition and clean up of 34 acquired properties, including 29 houses, a shop, BP garage, school room and the Methodist church.
1987-1988 Shire of Ashburton	Main road re-sealed from Auski Roadhouse to 14 kilometres east of Wittenoom.
1988 June State Government	Demolition and clean up of 15 acquired properties, including 14 houses and the school.
1988-1989 Shire of Ashburton	Part of racecourse cleaned.
1990 January	Demolition of Dumar Motel.
1990 April	Demolition of the Shell garage; clean up of children's playground.

The above summary is incomplete. There is a need in future to keep accurate records of the clean-up, particularly the disposal of soil containing tailings. The Shire of Ashburton office in the town should keep a copy of up to date information for local reference.

Observations of inquiry team - Town
- Settlement

The inquiry team observed that the level of tailings contamination in the town has been reduced considerably compared with the amounts recorded in the 1960's. Many areas in the town have been stripped of tailings whilst in the untreated areas most of the crocidolite has been removed by weathering processes or has become dispersed into the natural soil or rock. Such clean-up efforts were not observed at the Settlement.

2.34 Then and Now

Asbestos fibres in the general environmental air have been present long before human exploitation of these minerals. This is a result of natural geological weathering processes. The total amount of asbestos released from natural sources is much greater than that released from industrial sources. In general, ambient air concentrations rarely exceed 0.001 fibres/cc. At these levels, the risk to health is undetectably low, indeed very much lower than other risks such as background radiation. The EPA of Western Australia considers a risk in residential zones of 1 in a million a year is so small as to be acceptable (EPA Bulletin 278).

After the closure of the mine in 1966 there was no further exposure of town residents to dust generated by the operating mill at the minesite or nearby at the Settlement or the popular swimming places such as Town Pool, Garden Pool and Magazine Pool. Asbestos was no longer being trucked through the town past the government primary school. Mine and mill workers dusty clothes were not being brought home to be shaken out and laundered.

Since the closure of the mine there has been less airborne asbestos fibre and less risk to the residents of the town of contracting mesothelioma. Some tailings were carted into the town up to the late 1960's - resulting in the unnecessary exposure of residents and those involved in the cartage.

Closure of the town will not solve the problems associated with asbestos contamination for future generations. Both the town and the mine tailings will require removal and disposal or storage. Closure will have no effect on those people who will suffer from asbestos related disease because of previous exposure during the mining period or before the clean up of the town.

Expensive infrastructure will be lost and compensation will be paid to those who leave. The problems of tailings will remain.

The relocation of the town is not a realistic option. A clean-up of the existing town would cost much less than the expense of establishing a new town. The cost of adequate compensation for owners and the cost of demolition and the loss of valuable public infrastructure such as roads and services will be more. There will be a breakdown in the social structure of the town residents and all will face social upheaval.

Given the difference between the condition of the town in 1978 at the time of Dr A G Cumpston's air monitoring program and the present day, the 1978 measurements are only of historical and research interest. At the time of Dr A G Cumpston's survey there was no quantitative risk estimates for people living in the town. We now have an assessment of those risks and they have been included in this report.

Air monitoring shows the level of exposure of town residents to airborne asbestos fibres decreased following the clean up of the town which began in 1980.

The risk to current Wittenoom residents of contracting mesothelioma from current airborne fibres is discussed in section 2.10. The removal of soil from the remaining contaminated areas will further reduce this minimal risk in the longer term.

The tailings clean up programs in the town have not been as effective as they might have been. There is evidence of re-contamination of some sites. If there has been a policy on the disposal of contaminated soil, there has been a lack of supervision of that disposal.

Visits to the town and the area will continue even if the town is closed because of the scenic beauty of the area and the interest in the mining operation and the tailings dumps and to collect specimens of crocidolite. The fencing of contaminated areas around an abandoned town and the mine and mill some 10 kilometres away will excite curiosity. Fencing will not prevent access to those who are curious.

We have a duty to prevent the further spread of asbestos tailings to reduce the risk of mesothelioma to residents, current visitors and future generations. We also need to remove the visual pollution of tailings which are becoming more and more unacceptable to society at large. Therefore a complete clean up of the tailings at the town and mines is required. This can be done over an extended period. Asbestos fibres cannot be completely removed from the area but the current minimal risk of asbestos disease can be reduced to negligible levels.

The main problem is not the real health risk but the public perception of the risk to health which will have to be overcome before Government workers and private employers are prepared to return to the town.

2.35 Completing the Clean Up Program

The Shire of Ashburton have proposed a systematic clean up program that will minimise the risk of any significant contamination.

Other useful ideas to clean up and re-vegetate Wittenoom are outlined in submissions by Wittenoom residents.

The aerodrome should be cleaned up to minimise the health risk to people who use or visit the airport.

The area of new development should be confined to the business precinct, the community centre, the caravan park the residential area from Fifth to Seventh Avenue and the hospital. The town can be extended to the east if required since this are is not contaminated. Similar approaches on clean-up need to be applied to the Settlement.

PART 3.0 THE MINES AND SURROUNDING ISSUES

3.10 Geology

Asbestos is a generic name which applies to a number of silicate minerals whose strong, yet flexible, long fibres which can be used as heat resistant or chemical resistant material. Four asbestos minerals have been mined in Western Australia since the early 1900's. Three of these, crocidolite (blue asbestos), anthophyllite and tremolite are amphiboles. Chrysotile (white asbestos) is a fibrous form of serpentine.

Crocidolite or blue asbestos occurs in the Wittenoom region. It is an altered form of the mineral riebeckite, and is noted for its parallel, fibrous structure.

The mineral has been mined from two thin units within the Brockman Iron Formation of the Hamersley Group, where a 30-60 metre stratigraphic interval containing riebeckite zones with crocidolite horizons are found.

The rocks of the Hamersley Group are about 2400 million years old. They are sediments which have undergone low grade metamorphism, that is, alteration by heat and pressure caused by moderate to deep burial within the earth's crust.

3.11 Mining History

Mining was carried out in three separate locations, at Yampire Gorge at Wittenoom Gorge and at Colonial Gorge (Figure 1 and 2).

In 1937-1938 high prices for asbestos attracted prospectors to the Hamersley Ranges. Small amounts of milled asbestos fibre was produced by Western Australian Blue Asbestos Fibres Ltd and Messrs L G Hancock and P Wright in Yampire and Wittenoom Gorges. The Yampire Mine produced about 300 tons of asbestos fibre before it closed in 1946.

The Hancock and Wright operation was taken over by Australian Blue Asbestos Ltd a subsidiary of CSR in 1946. The new owners developed the Wittenoom Mine from 1946 -58 during which it produced about 20,000 tons of asbestos fibre and 600,000 tons of waste. A new milling plant was erected at the Wittenoom Mine in 1949.

The Colonial Mine operated from 1953-1966 producing about 130,000 tons of asbestos fibre and about 2.6 million tons of waste. Between 1958 and 1960 both the Wittenoom and Colonial Mine mills were operating. High dust levels continued to be a problem at the mine and mill.

In announcing the closure of asbestos mining operations at Wittenoom for economic reasons in December 1966, Sir James Vernon the Chairman of CSR said the mine had produced 131,000 tons of crocidolite of which over 100,000 tons of crocidolite were exported.

3.20 Yampire Gorge Mine

The Yampire Mine probably started in about 1937 and was abandoned in 1946. Production was probably about 300 tons of asbestos (crocidolite) fibre and about 15 000 tones of waste rock. The site lies within the Karijini (Hamersley Range) National Park (Figure 1).

Mines Department officers visited the site in July 1990 and made a number of recommendations in an internal report (Jones H 1990a). The report outlines aspects of the mine area which are physically dangerous to the public. The roof (backs) and walls (pillars) of mined areas are in a dangerous condition and the sealing of the two main openings to the underground mine (the portals) is recommended (Photographs 4 and 5).

The mine site is popular with tourists. The site contains a relatively small amount of tailings and mullock. The site should be cleaned up recovering as much blue asbestos tailings as practicable around the minesite. The tailings could be stored in Yampire Mine or buried.

The mine portals need to be sealed and the external rock face made safe (scaled). Rubbish should be removed. Signs warning of asbestos and the physical risk/hazard of the mine and mill area should be displayed. Remnants of the mill, mine and power house should be left intact as the site is a tourist attraction and part of our heritage. Some of the mine equipment of historical value should be salvaged and incorporated in a Wittenoom Museum. Considering the low level of contamination and risk, tourists should not be discouraged from visiting the area on the basis of exposure to crocidolite dust.

From an environmental point of view, use of the road as a major access road to the Karijini (Hamersley Range) National Park should be discouraged. The area contains the Fig Tree Soak wetlands which contain a classic stand of giant white gum (Eucalyptus Camaldalensis) and paperbark (Melaleuca Leucadendron). Access to Yampire should be restricted to entry from the Dales Gorge Road. The existing gravel road to the Wittenoom - Auski Roadhouse Road should be closed. Preference should be given to develop the catwalk at the Fourth Crossing in Wittenoom Gorge as a major entry point to the Park.

3.30 Wittenoom Gorge Mine

The Wittenoom Mine (Photographs 6 and 7) lies within Wittenoom Gorge about 1 kilometre upstream from the Settlement (Figure 2). The Wittenoom Mine operated between 1946 and 1958. The mill continued to treat ore from the Colonial Mine until 1960. Estimated production from the Wittenoom Gorge Mine is about 20 000 tons of asbestos fibre and about 600 000 tons of tailings which contain about 8 500 tons of unrecovered asbestos (Jones H 1990b).

In 1950, dust extractors (rotoclones) were installed at the mill. Further extensions were completed in 1952 and the mill was enclosed and extractor fans placed on the roof. In 1958 there was further installations of dust reducing equipment which did not solve the problem of elevated dust levels.

From 1946-1960 people living at the Settlement about one kilometre from the Wittenoom Mine would have been subject to environmental exposure of airborne asbestos fibre released from the mill. 600,000 tons of tailings from the mill were transported past the Settlement to Eastern Gorge during the same period. A small quantity of tailings were dumped upstream from the mine on the west bank of Joffre Creek.

We recommend that as much of the visible asbestos tailings as practicable should be recovered and stored in the Wittenoom Mine. If the mine is unsuitable the tailings should be transported to the Eastern Gorge dumps. All mining equipment of historical interest should be recovered and kept for display in a Wittenoom Museum.

Remnant structures such as the mill and the office should be left intact. Other rubbish including refrigerators etc and junk in Joffre Creek should be cleaned up. Entrances to the Wittenoom Mine should be made safe and sealed as required.

Signs warning about the presence of asbestos fibres and the risk of physical injury on the mine site should be displayed. Some of the bitumen road could be removed and the better sections resealed for a path as a tourist walk to the Karijini (Hamersley Range) National Park gorges.

3.31 Eastern Gorge Tailings Dumps

The Eastern Gorge tailings dumps contain about 600 000 tons of tailings extraced from the Wittenoom mine. Due to considerable erosion of this area rehabilitation is required. Although the final procedures will depend on a number of factors we suggest that if there is available storage capacity at the Wittenoom mine, a pilot program should be undertaken to sluice and pump Eastern Gorge tailings into the Wittenoom Mine. If this process proves too costly the Eastern Gorge tailings dumps can be consolidated, re-profiled into a single dump on the north side of Eastern Creek. The channel of Eastern Creek would need to be cleared of tailings which now block its course. The toe of the re-profiled dump would need to be protected with sand, heavy duty plastic and rock armour and drains should be constructed on the surface of the dump.

River sand contaminated with asbestos from Joffre Creek and other top soil could be used to assist with revegetation of the re-profiled dump.

3.40 Colonial Gorge Mine

The Colonial Mine (Photograph 8) started in 1953 and was closed in 1966. Production from the mine totalled 130 000 tons of asbestos fibre and 2.6 million tons of tailings containing about 56 000 tons of unrecovered asbestos (Jones 1990c).

Tailings were dumped in Colonial Gorge above the mill (upstream), in the vicinity of the mill and downstream on the west bank near the junction of Western Gorge Creek, Joffre Creek and Magazine Pool area.

This area contains the greatest extent of tailings which are highly visible and infringe on areas of active tourist routes and occupied areas for mine exploration bases.

The area needs to be cleaned up and we suggest depending on the success of the pilot program with the Eastern Gorge tailings, the tailings associated with the Colonial Mine can be sluiced and pumped into the Colonial Mine. Surplus tailings can be pumped into a dam constructed at the top of Colonial Gorge. Colonial Gorge Creek has a small catchment area compared to Western Gorge Creek (Photograph 9).

A spillway can be cut between Colonial Gorge and Western Gorge. The surface of the tailings dam would need to have drains incorporated, be bituminised, covered with soil and vegetated. A second dam, if needed to store tailings, could be constructed from Castle Point to the Colonial Gorge Mine. Excess tailings can be stored in a small re-profiled dump near the mill.

Lack of time prevented examining the possibility of diverting Western Gorge Creek (before it flows into Western Gorge) into the un-named Creek which flows east into Wittenoom Gorge immediately above the Wittenoom Mine. The watershed between the two creeks appears from a distance to be an iron rich scree deposit which may not need blasting when cutting a channel.
The dumps along the mine access road are mainly mine mullock (conveyor belt pickings) and are not a major problem. Some minor areas of tailings evident on air photographs, could be sluiced into drains below for recovery.

The Committee does not see any point in dismantling the Colonial Mine mill or any ancillary buildings at present but there is a need to contain the present exclusion of tourists from this site.

Public access to Colonial Gorge should remain restricted. Sightseers could view the mine from a viewing platform constructed on Lookout Point (Figure 3).

3.50 Discussion

There are many loads of tailings which have been dumped randomly between Garden Pool, Town Pool and the Settlement and around the Magazine area. These tailings need to be removed to Colonial Gorge. The Settlement area also contains visible tailings.

Tailings from both the Wittenoom Gorge Mine and the Colonial Mine contain mullock up to 300 mm diameter which was hand picked off the conveyor belt prior to crushing. This material could be screened from the mill tailings (usually less than 5 mm) to reduce the volume of material to be pumped into the mines.

A safe method of handling tailings would be to wet down the dumps with hammer sprinklers, then sluice the dumps with water jets draining the slurry into a channel to a sump, where they can be agitated and pumped as a wet slurry.

The tailings are considered at present to be a very low level health risk to visitors. Dispersal of tailings over the next century or two will increase that risk. From an environmental viewpoint the almost ad hoc dumping of tailings in one of the most scenic areas of the State amounts to environmental vandalism.

3.60 Dispersion of Tailings into Joffre Creek

The three million tonnes of tailings in the gorges appear to be quite static. Two major tailings dam bursts appear to have caused most movement of tailings.

At Eastern Gorge water built up behind the dumped tailings and burst through creating an outwash down to the junction with Joffre Creek (Photograph 10).

At Western Gorge another dam opposite the mill appears to have burst and created an outwash of tailings over the road crossing towards the Town Pool (Photographs 8 and 11).

The lower level Colonial Mine tailings dump on the banks of Joffre Creek appear relatively stable. After 30 years, the individual dump loads from the side tipping truck are still evident (Photograph 12). There is some scouring of dumps on the margins. It would appear that if the dumps are contoured and drained and water is not allowed to build up behind the tailings, then the tailings dump will be relatively static.

Whilst some contamination along Joffre Creek is from fibres dispersed from mine tailings, most of the fresh rock appears to be derived from tailings and rock dumped on creek crossing on the Wittenoom - Settlement Road prior to the concreting of these crossings. Other fresh rock and fibre together with domestic junk (ie household irons) near where the Wittenoom - Tom Price Road crosses Joffre Creek appears to have been derived from the old town rubbish dump near the margin of Joffre Creek west of the Wittenoom Racecourse.

3.70 Suggested Tailings Clean Up Program

The work required at the various minesites and tailings dumps can proceed over a five or ten year period. The following stages are suggested:

1. Clean up Yampire Gorge to reduce the risk to visitors to the Karijini (Hamersley Range) National Park.

2. Clean up of Wittenoom Gorge Mine which is a discrete problem.

3. Removal of random tailings dumps between Garden Pool and the Settlement.

4. Clean up of the Magazine area.

5. Trial removal of Eastern Gorge tailings until Wittenoom Mine is full.

6. Investigate the diversion of Western Gorge Creek into Joffre Creek above Wittenoom Gorge Mine. Investigate the capacity of the proposed upper dam in Colonial Gorge and the cutting of a spillway from Colonial Gorge into Western Gorge Creek.

7. Removal of the various Colonial Mine tailings dumps to the Colonial Mine and to the two proposed tailings dams above the mine in Colonial Gorge.

8. Re-profile, rock armour and revegetate consolidated dumps in Colonial Gorge and Eastern Gorge if dams and mine storage are too expensive.

PART 4.0 GENERAL

4.10 Tourism

The future development of Wittenoom lies in tourism. Wittenoom is a ideal location to service both the Karijini (Hamersley Range) National Park and the Chichester Range National Park. To a lesser extent Wittenoom will service pastoral and mining activities and may host an increasing number of Aboriginal people from the Bungima Tribe as they move back to their traditional lands in the Fortescue Valley near Wittenoom.

ASBESTOS ISSUES AT WITTENOOM

Wittenoom has always been a popular tourist destination particularly since the opening of the Karijini (Hamersley Range) National Park in 1969. Up to 40 000 tourists visit the area annually. The bitumen road from the Auski Roadhouse on the Port Hedland - Newman Highway now extends to within 14 kilometres of Wittenoom.

Despite the loss of tourist but activity due to government pressure, general tourism has not been hindered and has steadily increased. We believe that Wittenoom should be developed as a major access point for tourists to the Karijini (Hamersley Range) National Park by developing the catwalk from Fourth Crossing within Wittenoom Gorge. This is a particularly scenic and relatively safe route with vistas of the Fortescue Plain, Wittenoom Gorge and Bee Gorge. A lookout and carpark could be developed off this road on the Colonial Mine catwalk above the Colonial Mine. This would allow a spectacular view into Western Gorge where the Colonial Mill is sited. This road continues on to what is perhaps the most spectacular scenic attraction in Australia - Oxer's Lookout, Weano Gorge, Hancock Gorge, Joffre Gorge, Red Gorge and Knox's Gorge. This road continues on to Tom Price.

The Fourth Crossing catwalk should be developed to allow vehicle access to Yampire Gorge from Dales Gorge. This would allow the closure of vehicle access to Yampire Gorge from the Wittenoom - Roy Hill Road.

A museum depicting the entire Wittenoom saga should be set up within the township possibly at the vacant police station and court house. This to include the working and living conditions and the subsequent health problems of the people at Wittenoom with a list of those that have fallen victim to the crocidolite exposure. There are many fine examples of mining machinery and equipment which could be bought together at the museum. Visual displays of mining and the history of Wittenoom and a video display of the health and environmental consequences of asbestos mining could be a significant tourist attraction. The macabre is always an attraction and often an education so that similar industrial situations are not allowed to develop in the future.

It is important that walking access be maintained along Joffre Creek between the Settlement carpark and Oxers Lookout. Hikers will be able to view the remnant structures of the Wittenoom Mine. The remnants of the mines excite curiosity in travellers to these lonely areas.

There is strong tourist interest in the area from Europe. Tour operators in the area claim there is little knowledge of the area among the travel industry in Western Australia and from the eastern seaboard.

The spectacular scenery around Wittenoom is not included in the Karijini (Hamersley Range) National Park. As mining tenements are relinquished, as much as possible of this area should be included in the Karijini (Hamersley Range) National Park. Perhaps because of its scenic location and its past mining history, the Settlement could be one day re-developed into a resort.

Closure of the town will not stop tourists visiting Wittenoom Gorge and the associated mine sites.

4.20 Compensation of Mesothelioma Victims who were not Mine Workers

Compensation claims surrounding Wittenoom workers and residents have been long drawn out legal batles with high profile publicity and their result has benefited neither the government or the past mine owners. In many instances the claimants die before settlement. A significant proportion of mesotheliomas will arise from past residents of Wittenoom. We strongly recommend that a medical panel could be set up to compensate victims of mesothelioma who at some time lived in Wittenoom or had contact with Wittenoom, but who are not eligible for workers compensation. The wives and children of mine workers and others not associated with the mine who were exposed to asbestos should be able to claim. These people are not workers as defined in the Workers Compensation Act 1981.

The panel should be able to make a quick decision on the payment of compensation to eligible victims of mesothelioma, who usually die within 12 months of diagnosis. A maximum payment for mesothelioma should be set. The compensation panel should comprise:

- a thoracic physician
- a Wittenoom residents representative
- a Government representative
- a occupational health professional experienced in asbestos matters

and a number of the public at large. Legal representation before the panel should not be allowed. There should be one right of appeal after the initial assessment. This should be by personal representation only.

Claimants, because of the latency, would need to show they had mesothelioma, that they lived in Wittenoom, were not a worker as defined under the Workers Compensation Act 1981 and had not received a payment from a common law action. Any payment received from the Wittenoom Trust is to be deducted from the final payment.

4.30 Moral Obligation to Rehabilitate

The mining areas and some of the residential areas at Wittenoom have been left in a contaminated state. Whilst this may have been the norm in the 1960's it is not an acceptable practice to today's society. We have determined that the quantitative health risks from the asbestos tailings are small, we also are aware that the general public attitude will not continue to tolerate such large volumes of widespread contamination from a substance that they hold in great fear. Whilst the area retains its visual pollution, Wittenom will continue to attract the wrath of many people and this wrath will reflect on the government, past mine owners and any future non-asbestos mining activities in the area. We believe that this attitude from society will not disipate by simply closing down the town and fencing of the area.

In respect of the tailings, the legal obligation of the former miners to clean up the mess is not clear, however there is a moral obligation on the polluters to society at large to assist in the clean up of the environmental and albeit low level health hazard they created. The clean up should be tackled jointly with the State Government.

PART 5.0 HEALTH BASED CONCLUSIONS

Given the evidence gathered by the Committee, particularly that associated with the risk of residents contracting asbestos disease, we conclude:

1. A considerable health risk of asbestos related diseases has been found at Wittenoom due to past exposures.

2. The risks were highest in the mine and mill workers, lower in Settlement residents and lowest in the town.

3. A significant risk does not exist for current residents and visitors to the town.

4. The low level risk in the town can be further reduced by a continuing clean up and re-vegetation program.

5. There is a low level of risk associated with the tailings dumps at the mine sites and the continued natural dispersal of those tailings.

6. The public perception of risk associated with the tailings and the environmental mess of the tailings dumps in this most scenic area, also requires their clean up.

7. Any future occupational activities which disturb the tailings or associated roads would require assessment for compliance with occupational health and safety requirements.

PART 6.0 RECOMMENDATIONS

1. The town should remain open and be cleaned up in one program as submitted by the Shire of Ashburton.

   The central business district, the recreation centre, the caravan park, the hospital and the residential area bounded by Fifth, Sixth and Seventh Avenue should be preferentially developed.

2. The tailings at the mine site should be cleaned up over a five to ten year period.

   Options include pumping tailings into the mines, or dams, or consolidating and reprofiling dumps, covering them with top soil and re-vegetation.

3. Wittenoom should be allowed to develop as a tourist centre and include a museum and memorial to commemorate those effected by asbestos related diseases.

4. The system of compensation for past workers and residents needs to be rationalised. In particular, a Compensation Board needs to be formed to deal with past non-working residents.

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APPENDIX 1

A CHRONOLOGY OF EVENTS RELATING TO WITTENOOM.

1917	Occurrence of crocidolite in Hamersley Ranges first noted at the Mines Department.
1937-1938	Demand for long blue asbestos fibre in 1937-38 creates a small boom in the area. Many prospectors were engaged in the production of hand cobbed long fibre.
1938-1943	Some milled asbestos fibre was produced by West Australian Blue Asbestos Fibres Ltd and Mr L G Hancock in Yampire and Wittenoom Gorges. The former company closed down in 1941. Hancock and Wright interests were taken over in 1943 by Australian Blue Asbestos Ltd. Mr L G Hancock was retained as manager until 1948.
1943	**Yampire Mine opens** (Production to 1946 estimated at 15,000 tons ore for about 300 tons asbestos fibre)
1946	**Wittenoom Mine opens** (Production to 1956 was 590 000 tons of ore from which about 20 000 tons of asbestos fibre was recovered.
	Yampire Mine closes.
	Establishment of residential Settlement in Wittenoom Gorge about 1 kilometre downstream from the Wittenoom mine and mill.
1946	The major dust problem at Wittenoom was first pointed out by an Inspector of Mines.
1946 March 25	Australian Workers Union first argues for the inclusion of a dust allowance in the award. The claim was not allowed.
1947	Building of town of Wittenoom at the entrance to Wittenoom Gorge commences because of a lack of suitable area for expansion at the Settlement. Town is 10 kilometres from the Wittenoom Mine and mill.
1948 June 6	Dr Eric Saint, Government Medical Officer, wrote to the head of the Public Health Department of Western Australia warning of the dust levels in the Wittenoom mine and mill, the lack of extractors and warned about the dangers of asbestos and asbestosis.

ASBESTOS ISSUES AT WITTENOOM

1948	Mr L G Hancock replaced as manager at Wittenoom mine.
1948 May 13	Australian Workers Union asks for inspection at Wittenoom. A diesel engine was stopped because of diesel emissions in the mine. Subsequently found air filter on the engine was clogged with dust.
1948 July 7	Town named Wittenoom.
1949 July 15	Australian Workers Union argued at an arbitration hearing for the payment of a dust allowance. It was not until 1957 the Award was amended to include a dust allowance, because of "excessive" dust nuisance. Mill workers awarded an extra 6d per hour.
1949 November	The Occupational Health Committee of the National Health and Medical Research Council suggested that consideration should be given to the Industrial Hygiene Unit at the Sydney University undertake a field investigation at Wittenoom.
1951 August 17	Wittenoom now has 150 houses and a population over 500.
1951 September	Work force at Wittenoom consisted of: 97 Underground and bench work 34 Mill operations 62 Tradesmen 82 Townsite work
1951 October 27	A new power plant and power house installed at Wittenoom Mine. Electric locos are in operation and the mechanisation of mining is complete. Over 260 men employed in the operation.
1953	**Start of Colonial Mine** (Production to 1966 estimated at 2.66 million tons of ore for about 130 000 tons of asbestos fibre). Access roads to new mine started. Adits of mine cut in early 1954.
C 4058	
1953 August 7	Production at Wittenoom Mine was increased to over 10 000 tons of ore a month. (Power house completed, output 1800 kilowatts).

ASBESTOS ISSUES AT WITTENOOM

1953 August 19	Mines Inspector reports the installation of dust collectors should prevent "...much of the dust which is exhausted to atmosphere and drifts down and back into the (Wittenoom) mill. ...the worst feature of the mill is the cloud of dust which arises from the mill and then either drifts down to the ground or blows down the gorge" (towards the Settlement about 1 kilometre away).
1953 December - 1954	A series of reports by Mines Inspectors indicating excessive dust in mill.
1955 October	The State Government requests the Federal Government to subsidise the Wittenoom (asbestos) Mine at the rate of £5 a short ton. Wittenoom asbestos uncompetitive compared to supplies from South Africa.
1957	Mill workers awarded an extra 6d per hour for working in "excessive" dust conditions by a mining Board of Reference.
1958	**Closure of the Wittenoom Mine.** Wittenoom Mill continues to treat ore from the Colonial Mine (12,222 tons of asbestos fibre was produced in 1957).
1958	Installation of dust reducing equipment in the Wittenoom mill. Dust allowance is reduced to 3d per hour for mill workers.
1958 March 5	Representative of Australian Workers Union requests an unannounced inspection of the mill by the Workmans' Inspector because of the dusty conditions.
1958 March 25	Unannounced visit by Assistant Mines Inspector tc investigate the dust problem at the Wittenoom Mill.
1958 June 13	**Colonial Mill opens.** Wittenoom Gorge Mill still operating. Production target 25,000 tons.

ASBESTOS ISSUES AT WITTENOOM

1959 February	Sleggs C reports presence of mesothelioma in South African crocidolite workers. Published as Johannesburg Pneumoconiosis Conference Proceedings, 1960.
	Investigation by Public Health Department WA of the occurrence of silicosis and asbestosis in miners employed at Wittenoom.
1959	Annual Report of the Public Health Department expresses concern about numbers of Wittenoom men affected by asbestosis and their relatively young age and the extremely short dust exposures.
1960	**Closure of Wittenoom Mill.** All milling now conducted at Colonial Mill.
1960	Dr J McNulty of Public Health Department diagnosed the first mesothelioma case arising from Wittenoom. The patient had worked at the mine for two years in the late 1940's. (Published 1962)
1960 January	X-ray survey by the Public Health Department indicates considerable silicosis/asbestosis in the Wittenoom workforce. Immediate dust suppression requested.
1960 July 14	WA Mines Department received a reply from the South African Acting Government Mining Engineer indicating methods of airborne dust measurement and dust control and were informed of the problems of asbestosis and silicosis in South African asbestos industry.
1960 October 26	Dr J McNulty informs Mines Department of results of chest x-rays taken in September 1960. Out of 199 workers, 25 indicate early stages of asbestosis/silicosis, and 19 show advanced development. Evidence shows increasing severity with increased duration of exposure.
1961	Dr G Oxer, CSR Medical Officer, sought Public Health Department advice regarding the danger of blue asbestos, then wrote to Mr Frank Sheehan, Clerk of Council from the Tablelands Shire Council, advising him of the dangers. His concern was aroused by an inquiry from Mr Sheehan about the danger of asbestos tailings being used for roads, driveways and childrens playgrounds.

ASBESTOS ISSUES AT WITTENOOM

1961 May	Production of asbestos fibre to increase from 260 tons per week to 500 tons per week.
1961 October 2-10	Dr J McNulty requests a meeting between the management of Australian Blue Asbestos Ltd and representatives of the Public Health Department and the Mines Department to discuss the problems of asbestosis in the workforce and high dust levels. Agreement at the meeting, that attempts would be made to improve the ventilation in the mine and mill and to institute a system of improved fibre and dust counting.
?1962	Dr J McNulty wrote to the CSR's consultant physician warning of the dangers of exposure to asbestos. Included results of medical examinations carried out on workers at the site drew attention to the significant number of men seriously affected at early ages and short exposures.
1962 December 15	Dr J C McNulty of the Public Health Department publishes an account of the first victim of mesothelioma from Wittenoom Mine in the Medical Journal of Australia.
1962 October 23	Major collapse in the Colonial Mine.
1963 October 9	Long Wall Stoping suggested as a way of increasing efficiency of mining operation.
1964 Date	Request made by Public Health Department for an expert from NSW (Gersh Major) to measure and report on the dust concentrations in the mine and mill.
1965 July 25	Continued Mines Inspector reports indicating dusty conditions in the mill and mine.
1966 October 8	Mr Gersh Major from the Occupational Health Unit of the School of Public Health and Tropical Medicine commences air sampling program at the Colonial Mill and Mine using long running thermal precipitators.

ASBESTOS ISSUES AT WITTENOOM

1966 1st December	**Closure of the Colonial Mine**, the last operating mine at Wittenoom due to the economics of mining. Total production 1943 -1966 was 161,000 tons of crocidolite fibre.
1969	On the basis of mesothelioma risk, the UK introduces an exposure standard of 0.2 fibres/cc for crocidolite, in an attempt to restrict its use.
1973 October 27	A Public Health Department Inspector reported that tailings at Wittenoom were being sold at $15 per ton for making concrete.
1973 October 27	Air Monitoring - Public Health Department. Air samples taken in and around the township by Mr Moyle. They were examined in 1975.
1977 (Date?)	X-rays taken of the 146 adults at Wittenoom. No direct evidence of asbestos related disease detected in any x-ray.
1977 July	Air Monitoring - Public Health Department. Dr A G Cumpston and Mr D Sykes visited Wittenoom to take air samples. Samples taken by driving around the town in a car with a sampling head protruding from the boot of the car.
1977 November	Air Monitoring - Mines Inspector. A sample of dust from a personal sampler worn by a Mines Inspector for half an hour outside the school and one hour outside the hotel was found to contain approximately 0.2 fibres/cc. This equalled the British threshold limit for occupational exposure, and it was decided to embark on a more detailed sampling program.
1978 June 14	The Wittenoom Trust set up by CSR to provide financial help to ex employees affected by asbestos diseases.

ASBESTOS ISSUES AT WITTENOOM

1978 September	Air Monitoring - Public Health Department. A volunteer group of citizens wore personal dust samplers for periods of 6 hrs at a time.
1978	Foundation of the Asbestos Diseases Society to help victims of asbestos related disease.
1978 November	Government decides to phase out the town of Wittenoom. Decision follow the publication of a booklet "The Health Hazard at Wittenoom" containing the results of air sampling and an appraisal of world-wide medical information.
1979 August	Formation of the Wittenoom Health and Works Committee.
1980 October	Air Monitoring - Public Health Department. Long term air monitoring in the Wittenoom Primary School grounds using a vertical elutriator.
1980 December	Cabinet decided to ban connection of essential services (water and electricity) to new families arriving in Wittenoom.
1980	Hancock & Wright demolish 13 houses in the town.
1980 - 1983	Shire of Ashburton. Closure of some Wittenoom streets, a kerbing and resealing program completed. Tailings removed from town street reserves.
1981 March	The State Government, for the second time, reaffirms the phasing out of the town and initiates planning for a new tourist resort. This action, which followed the air monitoring of October 1980, caused resentment and frustration among Wittenoom residents.
1984 April 2	Air Monitoring - Public Health Department.
1984 October	State Government policy of phasing out Wittenoom modified to ensure existing State Government facilities and services and the Fortescue Hotel are maintained until alternatives are available.

ASBESTOS ISSUES AT WITTENOOM

1985	Hancock & Wright demolish about 60 houses in the town.
1985 March 26	Air Monitoring - Wittenoom Health and Works Committee. Wittenoom Health and Works Committee commissions the Geraldton Building Company to undertake the Wittenoom Environmental Engineering Study which involved air monitoring.
1985 December 18	Wittenoom Primary School closed.
1986 March	Air Monitoring Program - Department of Conservation and Environment. "Wittenoom Airborne Asbestos Study". 322 samples from 7 stations.
1987 May	State Government demolishes buildings and cleans up asbestos tailings from 34 acquired properties.
1988 May 25	First successful common law claim by an ABA employee with mesothelioma.
1988 May 28	First common law claim by a former wharf labourer who loaded blue asbestos from Wittenoom onto ships at Point Samson.
1988 June	State Government demolishes buildings and cleans up 15 acquired properties including the school.
1988 September 27	CSR acknowledges liability for asbestos related disease at Wittenoom.
1989 January 10	First successful common law claim for mesothelioma from a past Wittenoom town resident who lived there as a child.
1989 December 16	Wittenoom Police Station closed.

ASBESTOS ISSUES AT WITTENOOM

1990 January	Demolition of Dumar Motel.
1990 February	Air Monitoring Survey conducted by the Shire of Ashburton.
1990 March 19	Wittenoom Nursing Post, based at the old hospital is closed.
1990 March	Air Monitoring - Shire of Ashburton. Personal samples obtained on 2 Shire workers based in Wittenoom.
1990 April	Demolition of Shell garage.
1992 February	Present inquiry into Asbestos issue commences.
1992 May	Air Monitoring - NIOHS/Wittenoom Inquiry Study
1992 September	Inquiry reports to Premier Carmen Lawrence MLA.

APPENDIX 2

LIST OF SUBMISSIONS

Submissions were received from the bodies and persons listed below.

Department of Occupational Health, Safety and Welfare
Health Department of Western Australia.
O B Hawthorne & Associates Pty Ltd
Mr R Oliver Wittenoom
Department of State Development
Mr F Soter Wittenoom
Mrs O Soter Wittenoom
Mines Department
Western Australian Advisory Committee on Hazardous Substances.
Mr P Fitzgerald Wittenoom
Mr K Saligari Wittenoom
Shire of Ashburton Tom Price
Dr G Ranzetta Karratha
International Mining Technical Consultants Pty Ltd
Mr K & Mrs C Parsons Coolawanyah Station Via Wittenoom
Mr D Swift Wittenoom
Midalco Ltd (CSR)
Mr D Flynn Wittenoom
Environmental Management Plan for Wittenoom Townsite.
Discussion Paper of the Wittenoom Planning Committee.
Trades and Labour Council of Western Australia
Mrs L Thomas Wittenoom
Asbestos Diseases Society of Australia Inc.
Mr J & Mrs S Cox Wittenoom
Mr D Doust Wittenoom
Mr I Baird Wittenoom
Water Authority of Western Australia
Department of Transport and Communications
Dr A W Musk Sir Charles Gairdner Hospital
Environmental Protection Authority

APPENDIX 3

ACKNOWLEDGEMENTS

The inquiry members express appreciation to the following persons for the special assistance they provided.

Dr N de Klerk (risk calculations)

Mr G Conaty (TEM Analysis)

Mr J D Baker (historical photographs)