# THE ASBESTOS AND HEALTH DEBATE

## Grasping The Nettle

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**SUMMARY**
*For 20 of its 45 years history in South Africa the fibre-cement industry has wrestled with the technical and scientific, financial, marketing, industrial relations and psychological issues related to the use and/or replacement of asbestos.*

*The experiences of an industry which has faced up to the uncomfortable and often expensive challenges of working with a potentially hazardous material such as asbestos may offer a useful guideline to those enterprises that are still struggling to grasp the nettle.*

**OPSOMMING**
*Uit sy 45 jarige bestaan in Suid-Afrika worstel die asbessementbedryf reeds 25 jaar met die tegniese en wetenskaplike, finansiële, bemarkings-, nywerheidsverhoudinge- en sielkundige vraagstukke met betrekking tot die gebruik en/of vervanging van asbes.*

*Weens sy ervaring kan 'n bedryf wat die ongemaklike en dikwels duur uitdagings, om met 'n potensieel gevaarlike materiaal soos asbes te werk, die hoof moes bied, nuttige riglyne bied aan ondernemings wat nog sukkel om die mas op te kom.*

## 1. THE ASBESTOS AND HEALTH DEBATE

The so-called Asbestos and Health debate has featured prominently in medical, scientific, media and labour fields for many years and with increasing intensity since the early 1960's.

In spite of the "harmful effects" of airborne asbestos dust having been noted in 1899 (1) and considerable debate in medical and scientific circles prior to 1930, it was 1931 before His Majesty's Government in the U.K. published regulations controlling its use (2). At this stage the disease most associated with asbestos was asbestosis, a restrictive lung disease.

The Second World War and its aftermath tended to distract public attention until the 1950's when consensus was achieved in the medical fraternity as to the link between asbestosis and lung cancer (3). During the 1960's a paper by three South African researchers proved the link between asbestos and mesothelioma a cancer of the pleura or peritoneum (4).

Increasingly the media reflected medical concern and public indignation.

Logical targets included the asbestos mines and users of asbestos fibres, including manufacturers of lagging and insulation, textiles, building materials and pipes.

Fibre-cement, in particular, is a highly visible product and has therefore attracted its fair share of attention.

Discovered in 1898 by Austrian industrialist, Ludwig Hatschek, fibre-cement utilises the extraordinary characteristics of asbestos fibres (including resistance to heat, alkali, biological degradation and friction; high tensile strength and insulation properties) as a reinforcing agent in a cement matrix. Between 9 and 17% asbestos is used for various products with an average 10% for building materials and pipes.

In the past all three types of asbestos, crocidolite (blue), amosite (brown) and chrysotile (white) were used in South Africa. Today, however, mainly chrysotile is used.

The fibre-cement industry in South Africa stated in a small way with a plant in Wentworth, Durban, in 1918 (5). The first major factory was built by Everite Limited at Kliprivier near Johannesburg in 1942.

The fibre-cement (FC) industry implemented only rudimentary controls over the creation of asbestos fine dust in the 1960's. However, a serious attempt at dust control started in the early 1970's when the Asbestosis and Technical Sub-Committee of what was then called the South African Asbestos-cement Products Manufacturers' Association, requested a meeting with the Chief Air Pollution Control Officer of the Department of Health.

Agreement was reached that the industry would voluntarily strive to achieve the occupational air quality Exposure Limit set in 1969 by the U.K. Government, viz 2 fibres per millilitre (f/ml) (6). The target date of 1974 turned out to be too ambitious and the 2 f/ml level was finally achieved at the end of 1978.

While the F.C. industry had every reason to be satisfied with its progress, public opinion about, and fear of, asbestos was reaching dramatic proportions in the early 1980's.

The first half of the current decade saw the Asbestos and Health debate achieving a new degree of universality. Medical and scientific researchers debated issues such as the "threshhold level" and "dose-response relationships", housewives worried about the use of F.C. products in their homes, rural communities discovered themselves to be living on asbestos mine dumps, labour unions campaigned for an outright ban on the material and mesothelioma victims encouraged the media to record their slow and agonising deaths.

It is against this background that the F.C. industry tackled the Asbestos and Health issue over the past 20 years. This paper reviews the philosophy, actions and achievements of the industry in the belief that it may be useful to those industries which have yet to grasp the nettle.

## 2. A FRAME OF MIND

At the heart of the F.C. industry's philosophy lies a basic acceptance that asbestos is dangerous if not properly controlled coupled with a sincere belief that the material can be safely used under strictly controlled conditions.

Survival being the first objective of any enterprise, F.C. manufacturers recognise that only by behaving in a thoroughly responsible way can they justify continued use of asbestos as the reinforcing agent in their products.

"State-of-the-art-knowledge-and-control" has therefore become the guiding principle in the battle for perception.

2.1 "Knowledge" includes:

* Keeping abreast of the latest developments in the medical and scientific field internationally.
* Access to the world's leading authorities in the field.
* Understanding the motivation and information base of industry critics.
* Careful examination of industry's historical response and motivation.

2.2 "Control" includes:

* Engineering solutions to dust creation and capture.
* Technical monitoring of dust levels.
* Education of employees, customers and legislators on both the positive and negative aspects of asbestos.
* Health surveillance for those who are occupationally-exposed to respirable asbestos fibres.
* Research and development into replacement fibres wherever possible.

One of the key decisions by the fibre-cement industry in the early 1980's was to try and repair the historical perception that executives had deliberately downplayed the risks and were indifferent to occupational health issues.

The industry had long since mounted an impressive campaign to counter the risk to occupationally-exposed employees. But, in the words of one executive: "We thought that it was our problem to solve and resented outside intrusion. I guess we were not very good at communicating our concern or our achievements to the outside world. Perhaps it was anxiety about the future of our business that caused us to be less than co-operative with outsiders".

Not the least among challenges facing management was that many executives had themselves been exposed to high levels of asbestos dust during their careers. Public acknowledgement of the dangers of asbestos could only follow painful self-acknowledgement.

After a period of intense self-examination and having the advantage of seeing the inevitable progress of the debate overseas, the F.C. industry agreed to:

* Regard all criticism as an important and strategically valuable source of information and guidance.

* Adopt an open door policy and respond positively to all queries, regardless of the source, inviting even the most negative critics to "see for themselves".

In short, the industry decided to recognise anybody with even the vaguest interest in asbestos, particularly fibre-cement, as a potential partner in solving the problem.

This strategy, albeit frustrating at times, not only resulted in former "enemies" being seen as constructive critics but helped the industry come to terms with the inescapable fact that the future of one of its important raw materials was uncertain.

The F.C. industry was a late-starter at winning credibility amongst all partners. What progress has been made has been due to control of the facts (including acknowledgement of the uncomfortable facts), an open door policy and absolute determination to stay abreast of the state-of-the-art-of-knowledge-and-control.

## 3. THE PLAN OF ACTION

Changes in the philosophical mindset of industry management had to be supported by concrete action. The South African Fibre-Cement Manufacturers' Association (SAFCMA) Technical Sub-Committee had initiated important action steps, including the dust control programme (1972) and the appointment of an industry Health Consultant (1976).

In keeping with the new approach, however, it was decided to launch an all-embracing Asbestos and Health Programme in 1982.

A small Task Force, including the managers of the technical, marketing, personnel and research departments, was formed. An issue management consultant was appointed as co-ordinator.

The Asbestos and Health issue was broken down into its component parts:

### 3.1 Information and Education

It was important that the Task Force had a full understanding of the historical perspective of the issue and the following research and collation projects were launched:

* Locate, study and store all relevant scientific and management documents relating to the issue.

* Draw up a chronological review of the progress of the debate and the company's responses (this document revealed that the company had indeed implemented a great many, albeit unco-ordinated control measures).

* Study media files and all available sources in order to "plot" the progress of the debate and, in particular, to identify potential partners.

* Develop a historical benchmark in order that further progress could be measured. This included statistics such as records of asbestos-related-disease (ARD), workplace dust levels and stack emission levels.

* "Audit" the attitudes of all partners by meeting with them, asking their opinions and, where possible, initiating their suggestions.

The search for and recognition of hard facts had a cathartic effect on managers.

Classically, members of the Task Force experienced in full the emotions of denial, anger, hope, depression and acceptance before equilibrium was restored and the pro-active management of change continued.

Some of the important projects during this phase were:

* Compilation of a Position Paper in which the full consequences of excessive occupational exposure to asbestos were acknowledged along with, for the first time, a public admission that an alternative fibre research programme had been initiated. This Paper was first published in September 1983 and was widely distributed among all partners and, in particular, the media.

* Updating an information booklet and audio-visual for employees (first produced in 1976) in which the dangers were clearly explained and mutual responsibility for safe working procedures outlined. This was finalised in 1983.

* Publishing the SAFCMA booklet in which contractors are advised on the use of specially-designed cutting tools which limit the creation of respirable dust on site.

* Compilation of a Safety Manual, based on the advice of expert consultants and on the International Labour Organisation's Code of Practice (7). This comprehensive Manual covers a wide spectrum of activities affecting the industry (Appendix A) and was finally published in September 1984.

* Briefing documents for numerous contractors, consumers, public representatives and others who were concerned about the use of asbestos in fibre-cement.

The theme of the information and education programme has been consistent: Excessive exposure to respirable asbestos fibres can be harmful but the fibre-cement industry is confident that the material can be beneficially used if properly controlled.

## 3.2 Dust Control and Dust Monitoring

### 3.2.1 Dust Control

The industry's detailed response to the engineering challenges posed by the control of asbestos dust has been covered elsewhere (8), (9) and we briefly review these efforts here.

Prior to 1970 the industry had already invested quite heavily in dust control equipment but mainly in the interests of cleanliness and good housekeeping. Following the agreement with the Chief Air Pollution Control Officer in 1972 to reduce workplace fibre counts to 2 f/ml, major expenditure was required.

Dust control in the fibre-cement manufacturing process can be split into clearly defined areas:

#### 3.2.1.1 Handling and Processing of Raw Materials:

This is potentially the most hazardous area because it is the only time that employees are exposed to dry raw asbestos fibre. However, a great deal of work has been done in this area with the result that fibre counts above 0,5 f/ml are rare.

Dust extraction systems have been installed where the operator opens the bag of asbestos and feeds it into the mill in which the fibres are opened. The dust control system has been designed with the filter mounted on top of the mill so that the air flow is through the feed inlet and all loose fibres are drawn into the wet process. From this point on, the process is wet and there is little danger of respirable fibres being released.

The wet treated fibre is taken by an enclosed conveying system into the mixing process where the fibre (approximately 10 per cent) is added to other raw materials.

#### 3.2.1.2 Batching of Raw Materials, Mixing and Dewatering:

This is the least hazardous procedure because once captured in the cement matrix, the asbestos fibres will not become airborne in significant quantities.

Manual batching of raw materials has been almost totally replaced by mechanised systems for feeding and weighing.

#### 3.2.1.3 Machining and Working Fibre-cement Products:

This is the area in which the largest volume of dust is created. Although F.C. building products are wet-stamped according to customer specifications, final trimming is often necessary. Industry policy is to encourage customers to have this cutting done under the controlled conditions at the manufacturing plant rather than on site.

Apart from the extensive use of extraction filters, the industry continues to research methods to reduce dust created by cutting. Slow-running machines with tungsten carbide saws which create chips rather than airborne dust, are used where feasible.

3.2.1.4 **Recycling of Waste Materials:**

These result primarily from the need to cut products to size. Both wetwaste and hardwaste are recycled into the product, the latter having first to be crushed and milled. Hardwaste milling has presented a particularly challenging problem for engineers in that the system must, on the one hand, create fine material by crushing and, on the other, not release fibres into the general environment.

3.2.1.5 **Waste Management:**

Unfortunately, not all waste can be recycled and quantities of both hardwaste and slurry must be disposed of. A variety of solutions have been developed by factories depending on their location. These vary from collection and disposal by outside contractors to dumping under controlled conditions on company premises. Factory-controlled dumps are required to be covered with soil and grassed.

3.2.2 **Dust Monitoring:**

The procedure for dust monitoring has been explained in detail elsewhere (10) and we will briefly summarise here.

All workplaces where asbestos dust or F.C. dust could be generated are demarcated and numbered on a master plan for monitoring purposes. Two instruments are used for monitoring dust.

The first is the Tyndallometer, an easily portable instrument that uses the Tyndall effect to measure the concentration of all particles in the air with an aerodynamic diameter of less than seven micrometre and gives an instantaneous read-out. This instrument is tremendously useful to factories as it not only allows a large number of measurements to be taken in a short time but also makes it possible to quickly identify areas where a problem has arisen. Its "disadvantage" is that it fails to distinguish between fibres and spherical particles and that it also detects aerosols such as mist and smoke. This tendency to exaggerate the possible fibre count contributes, of course, to improved controls.

The Personal Dust Sampler (PDS) is used in conjunction with a light microscope to give a fibre count per millilitre of sampled air. It is used in strict compliance with an internationally-standardised method (11).

The sampler is normally mounted on a person and the breathing zone sampled by placing the 25 mm diameter membrane filter within 300 mm of the nose. Flow rate is 1 litre/min and duration is anything from two to eight hours. The filter is subsequently cleared and examined at 500 magnification in phase contrast light.

A very complex guide for identifying a respirable fibre is used:

* The particle must have a length at least three times the diameter;
* The diameter must be less than three thousandths of a millimetre;
* The length must be between five and 100 thousandths of a millimetre.

The strategy of dust measurement is that factories use only the Tyndallometer for their day to day control work and that they are audited by an independent team using the PDS.

A review of current dust reports in the FC industry (July 1987) reveals that there are no workplaces in the industry above the 1 f/ml Exposure Limit laid down in the Asbestos Regulations published in April 1987, and that the vast majority (more than 90 per cent) are routinely below 0,5 f/ml.

Both the Measuring Centres at Everite and Rocla have been recognised as Approved Inspection Authorities under the Asbestos Regulations of 1987 (12).

### 3.3 Health Surveillance

One of the uncomfortable realities of the Asbestos and Health Issue is that no amount of effort today can undo the effects of the past. Asbestos-related diseases have a latency period of between 10 and 40 years which means that current victims are now presenting the industry with the consequences of excessive exposure many years ago.

In 1976 the F.C. industry commissioned an occupational health specialist to institute a health surveillance programme. This programme has been refined over the years and the main features currently are:

* A full pre-employment medical examination, including clinical examination, lung function test, full size chest X-ray and review of employment history. Apart from establishing the candidates' health for comparative purposes, the pre-employment medical is designed to eliminate those with a history of chest diseases or those who have previously worked in the mining industry.

* Periodic follow-up examinations, the frequency increasing in proportion to length of service.

* Full information to employees.

* Access to medical records (with the employee's written approval) by personal and union doctors.

* Submission of suspect cases to the Workmen's Compensation Commissioner (where appropriate) for possible compensation.

* A supplementary Disability Pension Policy which ensures that every employee who is no longer able to work as a result of an ARD is able to retire without any loss in basic monthly income.

* The free health surveillance programme is available to all former employees. Compensation for an ARD is in direct proportion to their degree of disability.

Industry statistics (July 1987) indicate that a total of 171 cases of asbestos-related disease have been certified by the Workmen's Compensation Commissioner. Although exact records of fibre/years exposure are not available, this would represent approximately 0,5 per cent of the industry's workforce over the past 40 years.

### 3.4 Asbestos Replacement Programme

It is in this area that members of the Fibre Cement Association (renamed in 1986) were not able to find common ground. Everite Limited was committed to researching alternative fibres for building materials by a 1976 decision taken by the Swiss parent company. The F.C. pipe industry is obliged to continue using asbestos because internationally there appears to be no suitable alternative in sight for the replacement of asbestos in fibre-cement pipes.

Overseas manufacturers have investigated and are using synthetic and man-made mineral fibres for building material products. The fibres that offer the best solution in terms of performance, price and occupational health in the RSA are cellulose. For the moment these must be imported but it is hoped that a local cellulose source can be developed. To date non-asbestos fibre-cement has been launched in the flat sheet range of products.

A key decision taken by the industry is that there will be no let up in the control procedures developed as a result of the Asbestos and Health issue. Dust control and occupational health management will remain a priority regardless of the raw materials used.

## 4. ENVIRONMENTAL EXPOSURE TO ASBESTOS

The industry has been obliged to stay abreast of developments in the Asbestos and Health debate as it affects the general environment. Not only is it important to reassure customers (architects, specifiers and contractors) but the-man-in-the-street frequently wants to be assured that fibre-cement products present no risk to his family.

The present key areas of concern, as they affect the industry, have been identified as:

* Asbestos dust counts arising from cutting asbestos-cement products on site.

* Weathering of asbestos-cement products.

* Environmental pollution arising from industry stacks and waste disposal.

### 4.1 Cutting Asbestos-cement Products

Dust-free cutting tools recommended by the industry restrict the release of respirable fibres to well below the regulated Exposure Limit of 1 f/ml. The use of angle grinders – which is strongly discouraged by the industry – can generate peak fibre counts of up to 50 f/ml which means that more than two hours a day of cutting asbestos-cement with an angle grinder could result in the time-weighted Exposure Limit being exceeded.

Numerous static background samples taken at construction sites where fibre-cement building products are being cut show that there is no danger to the general environment. Fibre counts range from 100 to 1600 f/m$^3$ (13). (Note: environmental fibre counts have to be measured with a scanning electron microscope and expressed in fibres per cubic metre – ie. 1 million millilitres.)

### 4.2 Weathering of Asbestos-cement Building Materials; Asbestos in Water

Although not much work has been done on this subject in South Africa, studies in Europe (14), (15), indicate that weathering of F.C. materials is not likely to significantly increase average environmental levels. The reason is that any fibres that are released due to chemical attack on the cement matrix, often remain attached to small cement particles, making them non-respirable. In addition, fibres loosened from, for example, a roofing sheet, will invariably be washed off by rain water rather than suspended by wind action.

Since the scientific community appears to be quite satisfied that asbestos fibres ingested via the water supply present no problem in regard to human health (16), (17), (18), the small quantities of fibres released from F.C. building products into the water supply appear to be of little consequence.

### 4.3 Environmental Pollution from Industry Stacks and Dumps

The industry monitors stack emissions and these appear to be at acceptable levels – although there are no legislative requirements in this respect.

Static samples on the boundaries of F.C. manufacturing plants show levels of between 100 and 1600 f/m$^3$ (13).

Samples taken on one hardwaste dump in July 1984 showed unacceptably high counts of up to 9300 f/m$^3$ and this material was removed and consolidated into a soiling and grassing project in February 1986. Other dumps under the control of the industry average 300 f/m3. (13).

## 5. CONCLUSION

For approximately 20 years the F.C. industry in South Africa has wrestled with the technical and scientific, financial, marketing, industrial relations and psychological issues related to the use and/or replacement of asbestos in its products.

By resisting the temptation to ignore or minimise the risks attached to the use of asbestos and by adopting innovative strategies to cope with inevitable change, the industry has succeeded in surviving a major potential threat.

Occupational health programmes and the control of all forms of dust will remain a top priority in the industry regardless of the raw materials used.

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APPENDIX X

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EVERITE

SAFETY MANUAL

GUIDELINES FOR THE CONTROLLED HANDLING OF ASBESTOS

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STATUS: SEPTEMBER 1984

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