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Assunto: CASITILE ARTICLE

TO: ICA MEMBERSHIP  
ACPPA MEMBERSHIP  
OTHERS

Greetings:

I recommend that you read the attached article, co- authored by Prof. John Bridle of Asbestos Watchdog (UK), entitled "Casitile, the New Asbestos: Time to clear the air the air and safe 20 billion.

This is very interesting reading and I believe that it would certainly be appropriate that you give it a wide dissemination.

Regards.  
Clement Godbout  
ICA- Chairman

## CASITILE, THE NEW ASBESTOS: Time to clear the air and save £20 billion

By: Professor John Bridle and Sophie Stone MSc BSc (Hons)

### INTRODUCTION:

One of the biggest costs to those responsible for Britain's built-environment is now that involved in the management of asbestos. Under the current regulatory regime, these costs have been estimated at many billions of pounds. The purpose of this review is to show how recent research has demonstrated that much of the concern over what is generically known as 'asbestos' is based on a fundamental scientific confusion. If the lessons of these studies can be properly learned, it will be seen that a very high proportion of the costs involved in the management of asbestos could be avoided, with immense savings to the national economy.

### THE SOURCES OF MISUNDERSTANDING

'Asbestos' is not a mineral in itself. It is a collective term given to a group of minerals whose crystals occur in fibrous forms. The term 'asbestos' was adopted for the purposes of commercial identification alone; any use of it to define the properties of the minerals within the group as if they were all the same is based on a serious scientific error.

The major minerals covered under the umbrella term 'asbestos' are listed in Table 1.

Table 1. Minerals covered by the term 'asbestos'

Name	Formula
Chrysotile	$Mg_3 Si_4 O_{10} (OH)_2$
Crocidolite	$Na_2 Fe_5 Si_8 O_{22} (OH)_2$
Amosite	$(Fe,Mg)_7 Si_8 O_{22} (OH)_2$
Tremolite	$Ca_2 Mg_5 Si_6 O_{22} (OH)_2$
Actinolite	$Ca_2(Mg,Fe)_5 Si_8 O_{22} (OH)_2$
Anthophyllite	$(Fe,Mg)_7 Si_8 O_{22} (OH)_2$

There are 6 major minerals, divided into two quite distinct groups. The first group, the 'serpentines', consists only of the mineral chrysotile, derived from the Greek for 'fine golden hair' (Browne, 2003). This mineral has long, silky fibres and animal experiments have shown that chrysotile displays a biopersistence of 15 days or less. (Bernstein DM, Rogers R, Smith P, 2004). The second group is quite different. The five other asbestos minerals, known as amphiboles, have short, sharp fibres, with fibre bio-persistence levels ranging from a few years to a lifetime.

The three main commercial types of asbestos minerals are chrysotile (known as white asbestos), crocidolite (blue asbestos) and amosite (brown asbestos). By far the most commonly used type is chrysotile, comprising 90% of all asbestos used in the built environment. It is found in many countries, and of the six types, poses by far the least risk to human health.

Manufacturing products involving the three commercial types of asbestos has been a thriving industry for several decades and by 1900 asbestos was being used in over 3000 products. All these products can be classified into two types. The first consists

of those, such as asbestos cement, which encapsulate the mineral fibres within a matrix with a density greater than 1 g/ml (these are known as High Density Products). The second includes insulation boards and asbestos pipe lagging, where the raw mineral fibres are loosely sprayed with a substrate onto structures and where the density is less than 1g/ml (these are known as Low Density Products).

In recent years, fibres from both amphibole and serpentine asbestos have been extensively analysed in isolation, and their physico-chemical properties are well documented. It is now established and well known that amosite and crocidolite in their raw form are potentially very hazardous to human health. It is also generally accepted that chrysotile is very significantly less hazardous, posing little or no measurable risk to human health at present day mandated permissible exposure levels in the workplace (Hodgson and Darnton, 2000). So great is this disparity that amosite has been estimated to pose a health risk 300 times that of chrysotile, and that of crocidolite 500 times greater (Hodgson and Darnton, 2000).

By 1985 the use and supply of amosite and crocidolite were banned. In November 1999 the use of chrysotile in all building materials and virtually all manufacturing processes was also banned, by the Health and Safety Commission (HSC).

Although no new asbestos products are thus now manufactured in the UK, many asbestos containing materials (ACMs) remain in millions of the nation's buildings and products. Current legislation demands that any existing ACMs, except in privately-owned domestic premises, must be identified and managed.

By far the most commonly used ACM is chrysotile asbestos cement (AC), which current regulation now places on a par with all other ACMs. But around 200 studies have shown that the health risks from exposure to any chrysotile fibres released during the use and handling of this High Density Product (HDP) is extremely low (Hoskins and Lange, 2004). These studies confirm that chrysotile HDPs present no measurable risk to health.

In the manufacture of chrysotile AC, it is common practice to use a machine to render down the cement sheets from faulty production into a dust for re-use in later batches. Air monitoring tests carried out in the Lusalite factory in Portugal have shown that no actionable levels of chrysotile fibres were being emitted, despite the aggressive and violent reduction of the sheets in an unenclosed machine (Health and Safety Department, Lusalite). Similar official tests conducted in the UK, using a JCB driven over piles of chrysotile asbestos cement roofing sheets, confirmed that no actionable airborne chrysotile fibres were detected.

The most fundamental mistake made by the authorities has been to transpose the hazards posed by raw fibres onto the products made from them. It is scientifically nonsensical to attribute the health risk posed by a raw material to products made from it. If this approach were taken to every potentially hazardous material, no product would be left unregulated (nickel, for instance, is officially classified, like asbestos, as a Class One carcinogen, yet it is used to make euro coins).

Among issues studied by the research on fibre release has been the question of whether the properties of chrysotile fibres undergo chemical change when they are

used in ACMs. Where chrysotile is used in asbestos brake linings, for instance, it has been shown that heating the material (as occurs where the brakes are used) causes the chrysotile fibres to alter their chemistry and structure, transforming them into a different mineral: an olivine known as Forsterite ( $Mg_2 Si_2 O_4$ ).

Until recently less well documented, however, has been the question of whether a similar process occurs when raw chrysotile is added to cement. In light of the abundance of asbestos cement, by far the commonest use of asbestos in the built environment, this question becomes one of the greatest importance. This review aims to summarise the answers given by recent research, and to discuss their implications.

## **EXPERIMENTAL EVIDENCE AND EXAMPLES:**

One of the earliest UK studies to observe changes occurring when asbestos fibres react with cement was a paper in 1972 by Professor F. D. Pooley, "Asbestos Bodies, Their Formation, Composition and Character".

In 1980, another paper on the 'Characterization and properties of cement dust' (Deruyterre A, Baetten J, Helsen J, 1980) took this further, discovering that when chrysotile is added into a cement mix in the manufacture of AC products, the supposedly 'pure' chrysotile actually displays additional calcium that does not appear with raw chrysotile.

Both these studies echoed the findings of a paper written even earlier by N. Smirnov in 1962, 'The petrography of asbestos-cement'. Smirnov's study immersed asbestos fibres in the hydration products of Portland cement. After extensive analysis, he also noticed that a chemical reaction occurred between the two, creating chrysotile fibres that had altered their appearance.

The current implications of these papers are considerably more profound than they might have appeared to be in the 1960s and 1970s. Now it has been shown that pure chrysotile fibres are cleared very rapidly from the lung (low biopersistence) (Bernstein DM, Rogers R, Smith P (2004)). It also emerges that the fibres which have undergone chemical alteration are no longer respirable. The altered chrysotile fibres have very little chance of making it past the upper airways, let alone into the lung, as will be documented below.

Another study which found these alterations to chrysotile was a paper written by L. Elovskaya in 1992 entitled, "Modification of chrysotile asbestos under the influence of environment and cement hydration products in asbestos cement".

In a series of original experiments, using electron microscopy and energy dispersion tests, Elovskaya also explored the existence of a chemical reaction between hydration products in Portland cement and the surface of chrysotile fibres.

The conclusions drawn in Elovskaya's paper were that:

- a) fibres emitted from asbestos cement products in the course of their exploitation are significantly different from those emitted by raw chrysotile. Their surface characteristics, composition and crystal structure all change
- b) such chemical changes lead to a marked decrease in the biological penetrability of chrysotile fibres. Therefore any risk posed by asbestos cement becomes significantly less

In echo of these findings, Professor Pooley in 2004 wrote another paper, entitled “Report on the examination of asbestos cement products to investigate changes in character of its asbestos content”. This investigated Elovskaya’s and all previous findings, and found definitively that chrysotile fibres included in a Portland cement based matrix are chemically and structurally altered.

Samples prepared from the AC products and a control sample of pure chrysotile were subjected to dispersal in distilled water for preparation for X-ray diffraction with an electron microscope (EM). Samples of respirable AC dust were also generated and examined in a similar manner.

The conclusions which emerged from Professor Pooley’s report were unequivocal. They confirmed that mixing with cement induces chemical and structural change to the chrysotile fibres. Increased levels of calcium and silicon and an increased tendency to aggregate leaves the fibre definitively altered.

This report provided clear images of the altered fibres, confirming those from the papers previously published.

Figure 1 shows an EM image of the control chrysotile sample, whereas Figure 2 shows an image of the fibres from the cement dust sample. Figure 3 clearly shows the calcium and silicon bodies on the dust sample fibre, demonstrating the chemical change taken place.

Figure 1. EM image of chrysotile fibres

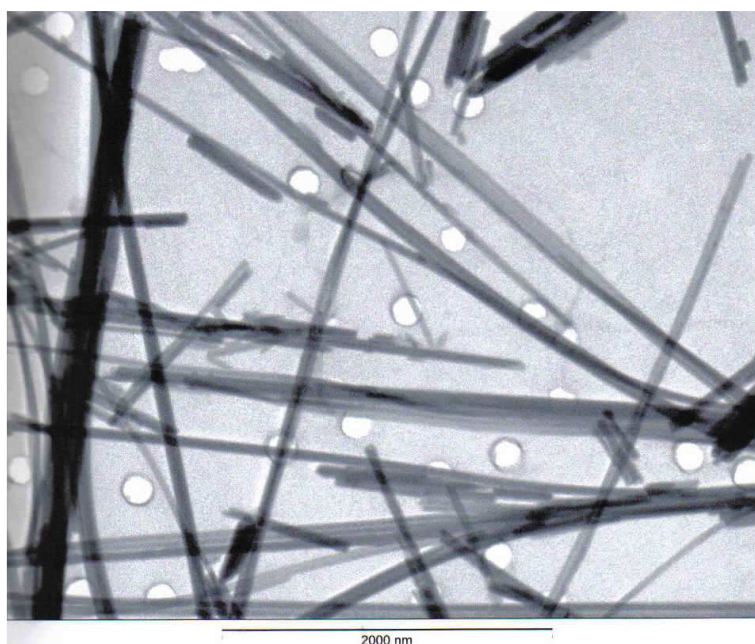


Figure 2. EM image of the fibres from the AC dust comparison

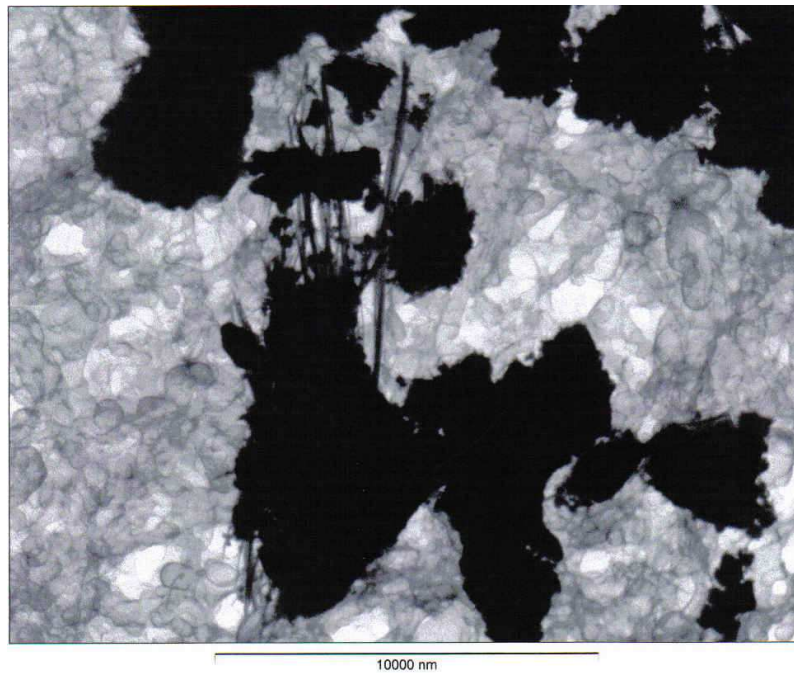


Figure 3. EM images of the altered chrysotile fibre with calcium and silicon bodies

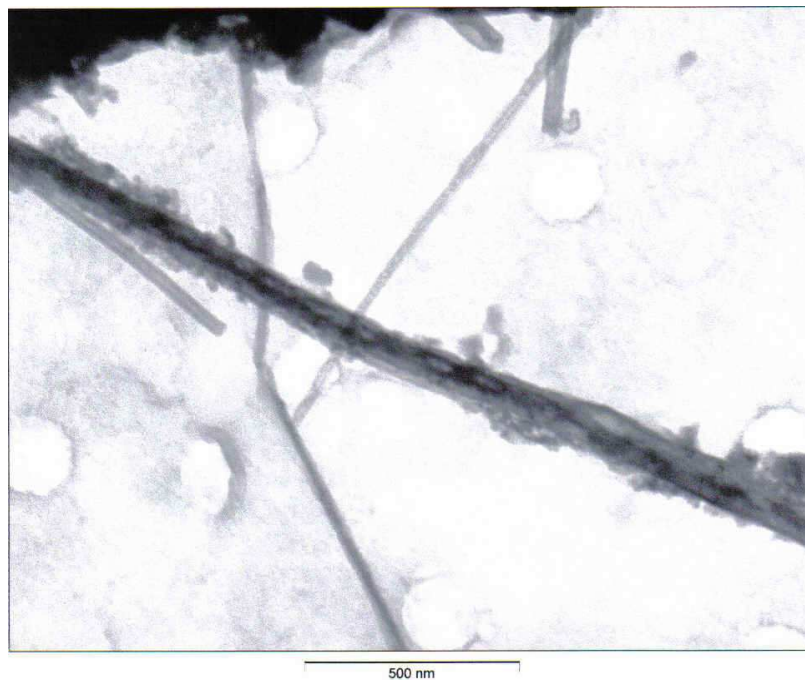
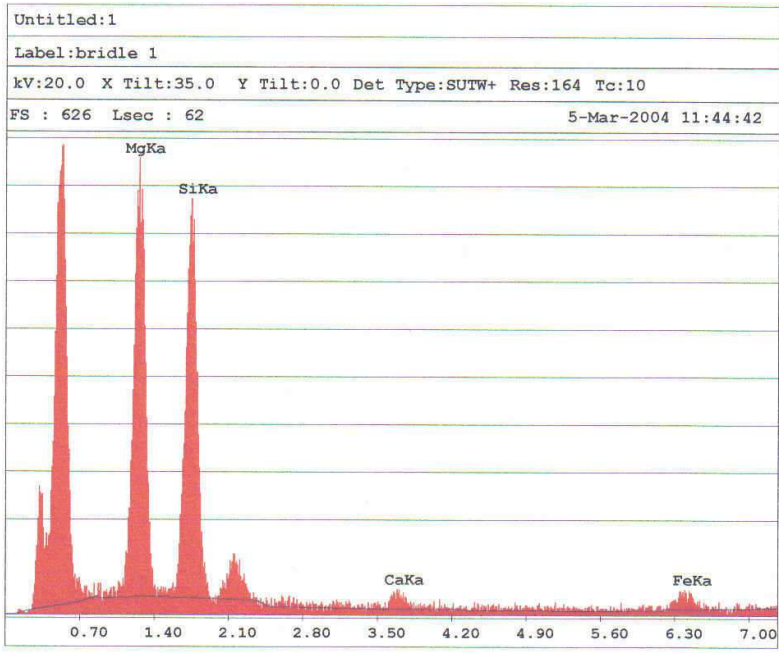


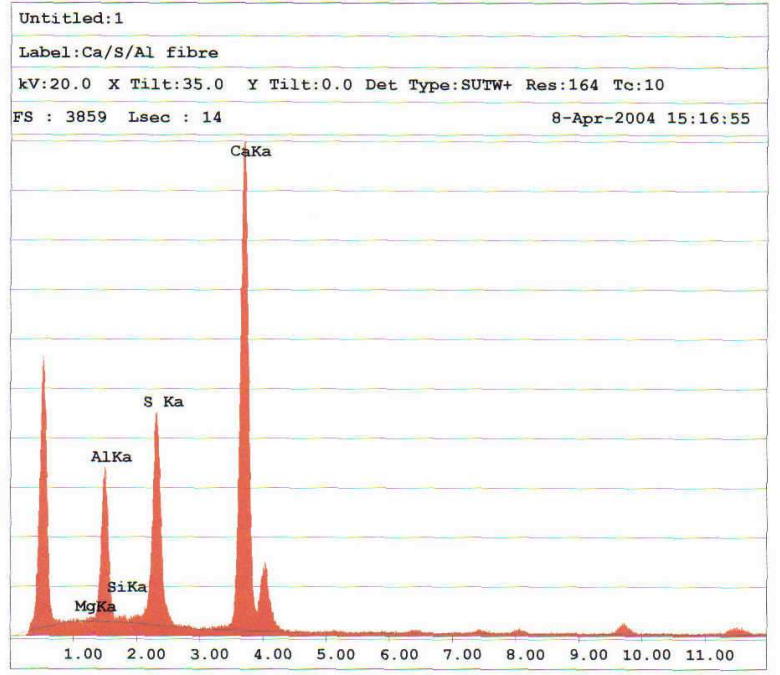
Figure 3 clearly shows the visibly altered nature of the AC sample fibre when compared with the pure chrysotile fibres in Figure 1. Figure 4 (below) shows the actual chemical analysis of the AC samples alongside a control chrysotile sample. The calcium and silicon spikes are consistently present in the dust sample fibre, significantly altering the chemical composition of what was once a chrysotile fibre.

Figure 4. Chemical analysis of fibres from a control chrysotile sample and AC samples



Thin Apx  
Theoretical KAB, Elements, Model : Zaluzec

Element	Weight %	Atomic %
MgK	45.5	51.3
SiK	44.1	43.0
CaK	3.4	2.3
FeK	7.0	3.4
Total	100.0	100.0



Thin Apx  
Theoretical KAB, Elements, Model : Zaluzec

Element	Weight %	Atomic %
MgK	0.2	0.4
AlK	11.3	15.1
SiK	0.5	0.6
S K	19.5	22.1
CaK	68.5	61.8
Total	100.0	100.0

So important are the implications of these findings that the Health and Safety Executive (HSE) has instructed the Health and Safety Laboratory (HSL) to duplicate Professor Pooley's investigation, the results of which it is hoped may be made available in April 2006.

## **DISCUSSION AND CONCLUSIONS:**

Of all asbestos containing materials in the world, 85% consist of asbestos cement (HDPs). The media interest surrounding this topic serves to highlight the vast numbers of people affected by concern over the dangers of asbestos, and by the costs which arise from that concern. If the significance of these research findings is properly appreciated and recognized, their practical implications could be immense.

One implication would be a breakthrough in preventing that hysteria which has been aroused by the general confusion and ignorance over 'asbestos' from spreading further than it has done already. If the general public can be reassured that 85% of the products they have been encouraged to fear as hazardous have in fact been rendered by the manufacturing process into a stable non-reactive material posing no measurable risk to health, this will be an enormous gain for common sense and for the national economy.

A key role here must be played by possible changes to the UK's asbestos legislation. If the HSL is able to duplicate the findings of these reports to the satisfaction of the HSE and the HSC, and if white asbestos cement products are seen as no longer containing the chemical which has been banned, this should eventually exempt such products from many regulations. One of the most contentious regulations to be affected should be the application of the Hazardous Waste Regulations. Currently under these, asbestos cement products are treated in exactly the same manner as loose crocidolite (blue asbestos), imposing potential costs on property owners and businesses which can scarcely be estimated.

A simple recognition that asbestos fibres locked into HDPs have been rendered safe by the attendant chemical process could potentially save billions of pounds; not only by drastically reducing the involvement of the asbestos abatement industry and in savings on waste disposal, but in legal fees, compensation and insurance claims. In total, it is not difficult to estimate the saving to UK businesses and property owners as amounting to £20 billion pounds.

Lastly but, ironically perhaps most importantly, there is the matter of a small name change. The findings of the papers in this review support the view that chrysotile fibres have been so altered, chemically and structurally, that it is no longer scientifically justifiable that they should continued to be defined as chrysotile. Since a new term is required to classify their altered state, one suggestion, in light of their chemical absorption of Calcium (Ca) and Silicon (Si), is that they should be called 'Casitile'.

Until now, confusion over the word 'asbestos' has acted as the major catalyst to a health scare that is in no way justified by 85% of the products included under this

loose heading. Perhaps it is fitting that the recognition of a new mineral 'Casitile', a fibre not under the curse of any existing legislation or prejudice, should be what is needed to restore sense to a debate which has become not only nonsensical but highly damaging to our society in general - and to all those who are individually being made to suffer for no scientific reason.

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