NOHSC
National Occupational Health & Safety Commission

NOHSC REPORT

# Chrysotile Asbestos Technical Assessment of Alternatives

MARCH 2001

# Chrysotile Asbestos

TECHNICAL ASSESSMENT OF ALTERNATIVE MATERIALS
IN THE EVENT OF A PHASE-OUT OF USES OF
CHRYSOTILE ASBESTOS IN AUSTRALIA

**March 2001**

A report prepared for the
National Occupational Health and Safety Commission
by Alross Pty Ltd

National Occupational Health and Safety Commission
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# FOREWORD

In seeking to achieve Australian workplaces free from injury and disease NOHSC works to lead and coordinate national efforts to prevent workplace death, injury and disease. We seek to achieve our mission through the quality and relevance of information we provide and to influence the activities of all parties with roles in improving Australia's OHS performance.

NOHSC has five strategic objectives:

- Improving national data systems and analysis,
- Improving national access to OHS information,
- Improving national components of the OHS and related regulatory framework,
- Facilitating and coordinating national OHS research efforts, and
- Monitoring progress against the National OHS Improvement /framework.

This publication is a contribution to achieving those objectives.

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# EXECUTIVE SUMMARY

This study examines the availability and safety performance of alternatives to chrysotile asbestos, with a particular emphasis on friction products and gaskets. The study also considers other factors which might influence the use of alternative materials and areas where continued use of chrysotile asbestos might be justified.

The study found that there was still extensive use of chrysotile asbestos in replacement road vehicle friction materials (anecdotal estimates suggest approaching 50%) and a strong prejudice common in the brake service sector at the shop floor level in favour of asbestos product. This prejudice continues in spite of the fact that new vehicles are all supplied with non-asbestos brake systems and the availability of a range of non-asbestos replacement friction products, often at competitive prices.

Large fleet operators in the heavy vehicle sector (trucks and buses) commonly use non-asbestos replacement brake friction materials and report satisfactory performance. Their approach is driven by a combination of industrial pressures and cost effectiveness.

There is very little contemporary public information on the comparative performance of asbestos product and non-asbestos product. The limited test data available to the study team confirms that it is technically possible to produce replacement non-asbestos friction product for road vehicle braking systems. Discussions with experts supports that view.

This conclusion is reinforced by the fact that new vehicles are asbestos free and by experience in Europe and particularly UK. The UK took specific statutory action in 1999 to ban the use of chrysotile asbestos. This action was taken in the context of regulation already in place requiring the use of non-asbestos product where technically feasible and demonstrates a confidence that the technology exists to develop satisfactory replacement non-asbestos materials. A number of temporary exclusions were put in place to provide additional time for industry to move to non-asbestos product. Several other European countries already have bans in place.

Consultation revealed that the friction materials industry in UK moved to develop non-asbestos friction materials on a voluntary basis, and has actively promoted their use. While alternative materials are widely available in Australia, the largest manufacturer continues to market a wide range of asbestos product. Importers also commonly offer asbestos product.

The current market situation in Australia is such that there would need to be a negotiated transition period to allow the friction materials sector time to adjust.

There is a need to address the common perception that non-asbestos friction materials are unsatisfactory. This perception is largely based on past experience with poor quality non-asbestos product, and a failure to properly “bed in” new non-asbestos components to achieve good performance. There is a need for a coordinated education campaign to address the issue.

There have been instances of poor quality imported replacement friction product and reputable importers commented that it was necessary to carefully monitor the quality of imported product from some suppliers.

There is no effective regulation of the quality of replacement friction product for road vehicles in Australia. This contrasts to Europe where there are standards for replacement friction product. Replacement components are required to be able to meet the new vehicle performance standards.

If the use of chrysotile asbestos is phased out in Australia, it may lead to increased pressure to develop performance standards for replacement friction product for road vehicles.

Non-asbestos friction material is available for other industrial uses, and widely used. There is common acceptance the substitute non-asbestos material performs satisfactorily. Many suppliers continue to offer asbestos product for those users who still prefer asbestos product.

In the aviation sector, the tight regulatory provisions mean that there is a requirement to only fit “approved” replacement parts including disc pads. On some older light aircraft, these were asbestos, but non-asbestos components are now available for many light aircraft. Non-asbestos replacement components may not be available for uncommon aircraft. Specific provisions might be necessary to address this issue.

In the area of gaskets, there is a recognition that it is possible to design seals for high stress environments using non-asbestos materials. Some major companies using complex high stress processing plants have moved to an asbestos free policy. There is some sensitivity in regard to the replacement of critical gaskets/seals in existing plant, but the evidence suggests that satisfactory substitute non-asbestos materials are available. Some re-engineering of joints and seals might be necessary.

Again the European experience shows that replacement non-asbestos materials can be developed given time. The EU and UK arrangements propose a limited range of short term exclusions to allow the necessary time for particular applications.

Similar conclusions apply to other industrial uses of asbestos. There is a common recognition of the need to negotiate a transition period.

There is broad recognition in industry that there is likely to be a move to ban the use of products containing chrysotile asbestos and manufacturers and importers are taking a range of actions to prepare for that eventuality.

For instance Bendix Mintex, the largest Australian manufacturer of replacement friction product, is understood to be planning to produce a non-asbestos replacement lining for light vehicle drum brakes. At present, Bendix Mintex only produces asbestos product in this category.

The Australian situation is different to that in Europe and specifically UK. There is no legal requirement to use non-asbestos substitute product in Australia, whereas the UK has had such legislation in place since 1987. While industry in Australia has moved to develop and market non-asbestos product, there is still widespread use of asbestos product.

Consequently there is a need to for a negotiation process, including stakeholders, to determine a general transition period for moving from asbestos product to non-asbestos product. The transition period would need to allow for:

- run-down of existing stocks of asbestos components

- the development and marketing of new product
- expansion of existing non-asbestos product supply to meet the increased demand

This general transition period should markedly reduce the need for specific exclusions. Australia is well placed to take advantage of international developments in non-asbestos product, further reducing the need for specific exclusions beyond the general transition period.

The time-scale of the transition period would need to be established in consultation with key stakeholders. Discussions suggest that stock run-down might require 2-3 years, while new or expanded capacity might require a longer period – say up to 5 years.

However there are sectors where a longer transition might be necessary. Aircraft and helicopters are an example where there are safety critical components which include chrysotile asbestos, and there may be a need for a longer transition period. Specific exclusions may be necessary to achieve this. The specific exclusions should be subject to a review process to encourage the development of satisfactory substitute materials and components.

The situation for older vehicles (over 25years old say) might also need special consideration as it may not be economic to produce replacement non-asbestos friction product. A long term exclusion (as in the UK) might be necessary for these vehicles.

Australia's federal system of government raises some complications in providing a uniform statutory basis to phase out the import, supply and use of chrysotile asbestos. The relevant powers are commonly with State/Territory governments, raising the problem of achieving uniform, national legislative measures. It may be necessary to rely on the import powers to address the primary objective. There will need to be a separate legislative basis to achieve the secondary objectives of supply and use. There will also be a need to provide a basis for managing specific exclusions, where individual import applications could be necessary.

# ABBREVIATIONS

| | |
|---|---|
| ADR | Australian Design Rule |
| CAWR | Control Of Asbestos At Work Regulations (UK) |
| CKD | completely knocked down |
| ECE | Economic Commission for Europe |
| EPA | Environmental Protection Authority |
| EU | European Union |
| FMVSS | Federal Motor Vehicle Safety Standard (US) |
| NICNAS | National Industrial Chemicals Notification and Assessment Scheme |
| NOHSC | National Occupational Health And Safety Commission |
| OE | original equipment |
| OEM | original equipment manufacturer |
| OHS | occupational health and safety |
| UK | United Kingdom |
| UN | United Nations |
| US | United States (of America) |

# INTRODUCTION

This study was undertaken for the National Occupational Health and Safety Commission (NOHSC) as part of a program of work to assess the implications of phasing out the use of chrysotile asbestos in Australia. The study team was led by Alross Pty Ltd, with Leslie Consulting and Commercial Vehicle Design Services providing specific technical input to the study program.

The study was restricted to performance and safety aspect of phasing out the use of chrysotile asbestos in industry. Crysotile asbestos products in place in the community (for example asbestos cement sheets, piping and moulded products in building construction, vinyl asbestos flooring, pipe and electrical coverings, conveyor belts etc) were outside the scope of this study. The health and safety aspects and the economic aspects are being addressed in separate studies.

## Report Structure

The report has been structured to deal with the major issue - road vehicle friction components - in some detail and then address the other relevant uses of asbestos product.

The report then addresses the area of exclusions, followed by a discussion of findings, a discussion on strategies and then conclusions.

## Work Program

The work program was divided into three main parts:

- light vehicle braking (Attachment 1)
- heavy vehicle braking (Attachment 2)
- the general industrial area where chrysotile asbestos is used for its special properties, often in combination with other ingredients. Aircraft are included in this section (Attachment 6)

Attachment 3 summarises some of the issues in developing non-asbestos friction materials, while Attachment 4 summarises relevant European (including UK) regulation. Attachment 5 canvasses issues in the Australian market.

## Consultation

The study team consulted widely in carrying out this project. Attachment 7 sets out the organisations contacted in the course of the study. The consultation was not intended to be exhaustive, but sufficiently broad to give a reliable source of data and information. It is worth noting that there is a common acceptance in industry that the use of chrysotile asbestos will be phased out over time.

## Terminology

In this report, the following terminology is used:

- “disc pads” refers to friction material (and backing plate) for disc brakes;

- “linings” refers to replacement friction material for light vehicle drum brakes; and

- “brake blocks” refers to replacement friction material for heavy vehicle drum brakes.

# FRICTION PRODUCTS FOR ROAD VEHICLES

## Industry Summary

The road vehicle sector currently markets asbestos free vehicles – cars, buses, trucks, trailers, 4WD, light commercial. The one vehicle identified in the NICNAS (National Industrial Chemical Notification and Assessment System) report is no longer offered with asbestos brake linings. The issue is therefore the replacement components market.

### Australian Manufacture

The major Australian manufacturer of brake pads and linings, Bendix Mintex, offers a wide range of replacement components, completely fabricated and ready for use. The company also supplies asbestos roll for passenger vehicle linings to brake bonders, and some part finished non-asbestos product to selected brake service companies (on the basis of technical competence, largely in bonding materials to brake shoes). It is understood that Bendix Mintex holds over 50% of the replacement parts market for friction products.

The Bendix Mintex product line includes a wide range of asbestos free product for replacement brake pads and heavy vehicle brake blocks. It also provides a comprehensive range of asbestos based brake pads, linings and brake blocks. Bendix Mintex do not yet market asbestos free replacement passenger vehicle brake linings, although they are understood to be developing a product. Their linings production process is extrusion based, while the asbestos free product so far has been a moulded product. It is understood that the problem has been one of manufacturing process rather than material technology.

There are also a number of small manufacturers of non-asbestos brake pads.

These companies also market pads in sets for a vehicle model, and typically offer a smaller range of pad composition products. (Bendix Mintex offers seven). They also typically cover a smaller range of models than Bendix Mintex does. This is offset to some extent by the fact that some of the smaller operators will make special purpose, small volume pads and mould new pads onto customers backing plates where the model is not covered in the product range. It is understood that these companies hold some 15% of the market.

### Imported Product

There are a number of established component importers, including spare parts suppliers and brake bonders who market a range of replacement brake pads, linings and brake blocks. Importers advise that both asbestos based and non-asbestos product is available from a range of sources. The viable sources are determined by initial cost and exchange rates. In general, product from Europe and US is expensive, but of high quality. Product from Asia/India is relatively cheap, but quality is variable. Product from South America, where many major vehicle manufacturers have established vehicle plants, is also variable, but those companies supplying the vehicle manufacturers with Original Equipment (OE) friction materials can supply reliable product of a high standard (generally meeting European Union/Economic Commission for Europe(EU/ECE) requirements.

Major replacement parts chains commonly import replacement friction material directly as well as offer Australian-made product. The major brake bonding business directly imports asbestos based product for relining drum brake shoes, and does not offer non-asbestos product.

There have been instances of importers who have marketed inferior product. This led to pressure to develop an Australian Standard for replacement brake materials. It is common knowledge in the industry that the quality of non-asbestos product needs to be constantly monitored, as small changes in the composition can lead to unsatisfactory performance. Importers who plan a long-term commitment to the sector are very conscious of product performance, particularly suppliers of the commercial vehicle replacement product.

**Service Sector**

Brake pads are marketed as boxed or packaged sets for particular vehicle models, normally as a pair for one wheel. These are installed by service stations, brake specialists and owners. Brake linings for drum brakes are supplied by the manufacturer as formed sets ready for attachment to brake shoes or as asbestos roll for passenger vehicle linings supplied to brake bonders. Most light vehicles linings today are bonded by specialist operators. For heavy vehicles, brake blocks (linings) are still commonly riveted rather than bonded to the brake shoes. This may reflect the fact that heavy vehicle operators tend to do maintenance in-house.

For popular models, brake bonders offer exchange services. The number of bonders has declined in recent years with the growing dominance of disc brakes in cars and light vehicles and the supply of replacement parts as ready-to-install units. Given the current situation in Australia, the brake bonders predominantly offer asbestos based brake linings.

Today, the majority of light vehicle brake service work is carried out by specialists or dealers and service stations. Some brake work is carried out by owners, but this is generally restricted to older vehicles.

The services provided by the specialist brake businesses include “skimming” disc brake rotors, replacement of rotors, relining brake shoes, surface grinding of brake drums and relined brake shoes as well as other brake services related to the hydraulic system.

While Australian and European disc pads are moulded to backing plates, in the US disc pads are commonly riveted to the backing plate. It has been suggested that this is largely a reflection of industry practice and geography. For some US vehicles, (generally older models), replacement pads are available from Australian manufacturers eg Bendix Mintex. For others, replacement pads are imported through specialist suppliers.

The heavy vehicle sector differs from the light vehicle sector. While there are specialist brake service operators in this sector, many large fleet operators carry out their own brake service work. In addition, heavy vehicle fleet operators are conscious of their costs and industrial relations, and many watch brake system costs closely.

There are major differences in the life achieved in different operations. A vehicle, bus or truck, operating in an urban environment may require brake service every 6 months, or around 30,000 km, while a vehicle engaged in highway use may achieve lining life well in excess of 150,000 km. Vehicles operating in remote areas will achieve lining life well in excess of this.

Another major difference is that large fleet operators tend to use non-asbestos replacement product for a range of reasons, including industrial relations/occupational health issues as well as economic/financial analysis. There is also the issue of asbestos disposal.

There are different views in the small fleet operators. Many are influenced by initial costs, and some strongly believe that they achieve longer brake life with asbestos based replacement product. This difference in views might be explained by the poor performance of the early non-asbestos materials, and/or poor quality imports. Small operators tend to be strongly guided by personal experience, and more sensitive to initial cost. It is also likely that the suppliers of quality non-asbestos product (both locally produced and imported) would target larger operators directly, and less marketing effort would be expended on small operators.

**Market Perceptions**

The brake service sector is characterised by strong views, often contradictory. For instance, there is a strong view that there are still problems with replacement non-asbestos friction materials. While these issues are often related to "consumer" issues such as noise and "black dust" on the wheels, there is a common view that non-asbestos materials do not give the same life as asbestos based materials. There is also a common comment that customers (in the light vehicle sector) are often unhappy with the "feel" of their brakes when non-asbestos product is used.

The "feel' issue might well be related to the need to "bed in" replacement non-asbestos friction materials, particularly linings and brake blocks. "Bedding in" requires a number of severe brake applications and many brake service operators may not carry out this procedure before delivering the vehicle to the customer. This is a carryover from past practice as asbestos friction materials do not require "bedding in" to the same extent.

It is easy to see a cycle where vehicles are not properly prepared through "bedding in" and customers complain. Brake service operators then conclude that non-asbestos product is unsatisfactory and offer asbestos as an alternative. Customers are also left with a perception that non-asbestos replacement product is not satisfactory.

There are also other aspects that contribute to the prejudice against non-asbestos product. For instance, the braking system of modern cars is designed to deal with a much higher performance level, and as a consequence, the expected life of disc pads and rotors is much lower than in the past. A typical disc brake rotor of a vehicle of the late 70s/early 80s will last for several cycles of replacement pads, and the pads themselves will give extended life. In a modern family vehicle, it is not uncommon to replace both pads and discs rotors before 50,000 km. This change is commonly attributed to the non-asbestos friction material now in use on new vehicles. Technical advice suggests that the change is to do with brake system design, not the friction material.

Operators in the brake service sector commonly recognise that asbestos based materials will ultimately be phased out. While those whose business is dominated by asbestos based components will argue strongly for the better performance of asbestos based materials, most recognise that it is likely that asbestos based materials will eventually be phased out, following the European model. Their primary concern is that sufficient time is allowed to "run down" existing stocks and source suitable non-asbestos product in quantity.

## Performance Regulation

The basic performance criteria for vehicle braking is the Australian Design Rule (ADR), ADR 31 for cars, ADR 33 for motor cycles and ADR 35 for commercial vehicles, and 4WD and ADR 38 for trailers. The ADRs set the new vehicle braking performance and are a comprehensive on-vehicle test system. The problem is that the ADRs apply to new vehicles only. The Federal Motor Vehicles Standards Act, 1989, under which the ADRs have effect, specifically applies to vehicles when first offered to the market in Australia.

There are other regulations for vehicle braking in the international arena. The main ones are Economic Commission for Europe (ECE) Regulations (the "United Nations International Standards), European Union Directives (generally aligned with the technical requirements of the relevant ECE Regulation), US standards (FMVSS regulations) and Japanese standards. Australia regards the ECE Regulations as the "international" standards, and US, Japanese and EU standards as regional standards. Australia has a harmonisation program in place, and has recently signed the "1958 Agreement", the treaty governing the operation of the UN/ECE system of vehicle regulations. While this does not require Australia to replace the ADRs with the ECE Regulations, it does provide added impetus to harmonise with the ECE Regulations ie to accept ECE Regulations without caveat. Currently, Australia commonly accepts much of the technical content of ECE Regulations, but frequently with caveats. Under the new regime, to formally take up an ECE Regulation, Australia would not be able to place caveats on the regulation, but would be able to accept other regulations (including current ADRs) as alternatives if it so wished. The emission ADRs follow this philosophy, allowing US EPA regulation for heavy vehicles.

The performance of a vehicle in-service is regulated through State and territory regulations, and there have been strong pressures to apply consistent regulation across Australia through the National Road Transport commission. There is currently a consistent set of "in-service" regulations in place. The principle basis for the in-service regulations is that the performance of the vehicle is maintained through its life ie the vehicle will continue to meet the performance requirements of the ADRs.

For braking systems, this requirement is not enforced in practice. The brake tests are expensive, and any serious attempt at enforcement would have significant cost implications and require a major change in industry practice.

It is worth noting that the ECE Regulations include a regulation (ECE R90) addressing the performance of replacement friction materials. The ECE braking Regulation, ECE R13, prohibits the use of asbestos. The friction materials regulation, ECE R90, essentially requires that replacement materials meet the performance requirements of the braking regulation – requiring testing for every vehicle model. The packaging and identification of replacement pads and linings is also addressed. The EU Braking Devices Directive mirrors the ECE Directives.

## International Developments in Friction Materials Regulation

The European Union has developed directives on the phasing out of chrysotile asbestos. While it is understood that the over-arching Directive is held up in process, the braking system Directive (98/12/EC) was published in March 1998. This Directive aligns with technical parameters of ECE R13 and for replacement linings for vehicles up to 3.5 tonnes, the requirements of ECE R90.01.

The directive requires the prohibition of asbestos in both new and replacement brake system friction materials for all vehicles built after 1 January 73 and introduces packaging requirements for replacement friction materials.

The UK has had a requirement to use asbestos substitutes in place since 1987 in the Control of Asbestos at Work Regulations (CAWR). The regulations require the use of asbestos substitutes if the substitute is available and less risk to public health. It is important to note that cost is not a relevant criteria. A relevant press statement states:

> "If it is technically possible to use a safer material than asbestos, this must be done".

"Safer" in this context means less risk to public health and the UK Department of Health Committee on Carcinogenity has concluded that "three commonly used asbestos substitute fibres are safer than chrysotile asbestos".

UK introduced regulations in 1999 for the general phase out of chrysotile asbestos and the specific issue of replacement brake linings and pads.

The UK position on friction materials has been reached through government – industry cooperation. Industry recognised the pressure to phase out chrysotile asbestos and developed suitable non-asbestos materials for brake linings, pads and brake blocks. There was also a benefit for the industry in no longer requiring special procedures and associated regulation to work with chrysotile asbestos. There is an exemption for pre 1973 vehicles, but this follows the EU Directive and is seen to be largely an economic decision rather than a technical or performance decision. This follows a concern that the small market for replacement friction product for older vehicles might lead to friction product manufacturers deciding that they would not invest to supply that market with non-asbestos product. It also reflects the fact that these older vehicles are generally enthusiast's vehicles which are well cared for and travel very low mileages ie they do not require frequent brake servicing. The UK regulations also provide a range of temporary exemptions for areas such as aviation where safety is an issue. These exemptions are to be reviewed over the period to 2005.

On a broader front, the proposed EU directive makes only one longer term exemption for products containing chrysotile asbestos – a diaphragm for chlorine pumps. Even this exemption is to be reviewed keeping the pressure on the industry to develop substitute materials. It is relevant to note that a major chemical company in Australia advises that asbestos is not used in electrolysis in their Australian operation. A range of other temporary exemptions is proposed, but all phase out by 2005. However, the exemptions are to be reviewed before they lapse to allow for a case to be made where a satisfactory substitute has not been developed. Experience in member countries with bans in place shows that satisfactory substitutes can be developed for virtually all uses of chrysotile asbestos given reasonable time and incentive.

In the US, the Environmental Protection Authority (EPA) put regulations in place in 1989 to phase out chrysotile asbestos, but these were overturned in a court action, largely on the basis that due process was not followed. It is understood that the EPA has not revisited the issue in court or through new proposed regulations, but continued to press through other avenues (voluntary agreements) to eliminate the use of chrysotile asbestos in vehicles.

This paper focuses on the European regulations as they are both contemporary and relevant to Australia. The relevance flows from Australia's long commitment to the

ECE Regulatory process in the vehicles area, and the recent accession to the 1958 Agreement, the Treaty governing the operation of the ECE regulatory process. Australia has a history of supporting the ECE Regulations as the proper "international" regulations under the UN. The US regulatory system for vehicles, on the other hand, is based on self regulation for safety and a formal approval process for emissions. It is also a regional rather than an international system.

## The Market for Replacement Friction Product for Road Vehicles

The Australian market is characterised by one major supplier (Bendix Mintex) understood to have over 50% of the market. Bendix Mintex offers a range of seven varieties of non-asbestos disc pads, one range of asbestos disc pads, asbestos replacement passenger vehicle linings, asbestos roll for passenger vehicle linings for drum brakes and asbestos and non-asbestos products for heavy vehicles. The remainder of the after-market is served by a number of small manufacturers of replacement disc pads for light vehicles (around 15% market share) and by importers of both asbestos and non-asbestos product. The vehicle manufacturers offer OE replacement friction parts, fifteen years for most models. Some heavy vehicle manufacturers using US break systems, do not carry stocks of OE brake blocks but supply (for cost reasons) aftermarket parts.

The replacement parts chains offer replacement friction products to the public at large. Some offer both Australian product and imported product.

The brake service industry today for light vehicles is characterised by replacement parts offered "ready to fit" ie the parts are finished and ready for installation in the vehicle. This is achieved by manufacturing replacement components for disc brakes ready to use, and by specialist "rebonders" who generally offer supply of re-lined shoes for popular vehicle models (largely on an exchange basis) and a service to reline the vehicle brake shoes for less popular models. When drum brakes were the dominant brake type for light vehicles, the "rebonding" sector was quite large and dispersed. Today, rebonding is more confined to a few large specialised operators who can offer some economies of scale.

For heavy vehicles, replacement friction components are generally offered as ready to fit linings or "brake blocks". While there are still specialised heavy vehicle brake service businesses, many large fleet operators do their brake maintenance in-house. Riveted linings are still the most common, although bolted linings are available for some models and bonded linings are used in some applications.

Many importers of non-asbestos replacement friction product for heavy vehicles offer their product directly to fleet operators and market on the basis of superior performance and longer life off-setting the initial cost premium. Most importers also offer asbestos product to meet customer demand.

This market sector contrasts to the situation in Europe, specifically UK. There the sector is dominated by the large replacement parts chains that operate in intense competition in the market. Replacement parts are sold "ready to fit" and packaged predominantly in "axle sets". There is less rebonding of used brake shoes.

This structure is partly the result of a much larger market and partly the result of the regulatory structure in Europe. In particular, the use of asbestos in new vehicle linings has been banned for some time and there are regulations controlling the performance of replacement friction product. These regulations require that the replacement product be capable of meeting the performance requirements of the

braking regulations and set out packaging requirements. There are also regulations (CAWR) requiring the use of non-asbestos product where technically feasible.

In this climate, the UK friction material manufacturers moved on a largely voluntary basis to develop non-asbestos replacement friction product, and the use of asbestos product has been minimised. While there is no comparative data available on the performance of the non-asbestos product compared to asbestos product, the regulatory environment effectively requires that the non-asbestos product also meet the new vehicle brake performance requirements. Consequently there is unlikely to be a problem with poor quality product. The labelling requirements also tend to ensure that the product is supplied “ready to fit”. There is understood to be virtually no “re-bonding” of existing brake shoes, probably because the production volumes allow economies of scale which mean that it is cheaper to supply the complete product rather than to re-use existing brake shoes.

# ISSUES

There are a number of issues in the replacement friction component sector.

## Issue 1: Replacement of Non-asbestos Components with Asbestos Components

The first issue is the fact that many operators and owners choose to fit asbestos linings to vehicles originally fitted with asbestos free linings. This is because of the price difference, and a perception of improved performance and longer brake component life. The performance perception is also due to the fact that brake service operators may not regularly "bed in" replacement non-asbestos materials, returning the vehicle to the customer in a condition where the new brake components do not perform to their potential.

The anecdotal evidence is supported by the fact that the trend in asbestos imports does not reflect the move to fit new vehicles with asbestos free friction materials. While there is effectively no restriction on the use of asbestos based replacement disc pads and linings on vehicles designed for non-asbestos materials this situation will continue. Local manufacturers are not inclined to invest in equipment to produce non-asbestos replacement product for brake linings while they face competition from asbestos. Importers will continue to bring in asbestos product and the local manufacturer of asbestos product will continue to produce the product while the market exists.

The introduction by Bendix Mintex of the new competitively priced Premium non-asbestos range should begin to help address this issue for light vehicles. However, it will be necessary to address the industry practices issue to change the performance perceptions

Heavy vehicle large fleet operators are more likely to fit non-asbestos replacement brake blocks. This is a reflection of corporate ethos in conjunction with industrial relations/occupational health and safety concerns (including requirements for the disposal of asbestos), coupled with improved performance of non-asbestos replacement parts. There is still a perception among some small fleet operators that asbestos product offers better performance (primarily lining life) and lower cost.

## Issue 2: Replacing Asbestos Components with Non-asbestos Components

The second issue is the question of replacing the brake friction materials in vehicles originally fitted with asbestos equipment with asbestos free friction materials. The issue is that the performance of the replacement pads/linings may be different to that of the original brake system. The degree of difference, and the direction of the difference – better or worse – are variable, and there is little quantitative information available. However, replacement non-asbestos disc pads are on offer in the market for these vehicles, and there is no substantive evidence of problems in the field.

The point is that the driving force behind brake system development for light vehicles has been weight and performance, not the need to use non-asbestos friction materials.

For heavy vehicles, there is evidence that there were no changes to the brake system when vehicles were re-certified for non-asbestos friction materials. This suggests that there would not be significant performance issues if asbestos product brake linings were replaced with asbestos product linings. The practices of some operators also suggests the reverse – that non-asbestos linings can be replaced with asbestos product linings without performance problems.

## Issue 3: Substandard Product

The third issue is that there is no effective regulation of the quality of friction material replacement components in Australia and sub-standard components are or have been offered in the market – at a substantial price discount. This contrasts to the highly regulated situation in Europe.

## Issue 4: Comparative Performance Data

The fourth issue is the lack of comparative performance data in the public arena.

The performance of friction materials in vehicle brake systems is a complex issue. Brake system designers develop vehicle brake systems to provide the appropriate performance at minimum cost. There are many factors affecting brake system performance, and many design parameters relevant to the development of friction materials. The performance data available is quite limited, and generally restricted to particular vehicles. The recent moves in Europe show that it is possible to develop non-asbestos replacement friction materials which will meet the performance requirements of the new vehicle regulations.

The team has access to some limited test data which confirms that it is possible to develop replacement friction materials which meet the performance requirements of the ADRs. This again confirms the European experience.

## Issue 5: Wide Range of Product Available in the Market

The fifth issue in the Australian market is the wide range of replacement product available. The problem is not one related to the phase out of asbestos product, but rather one of consumer education and product standards. There is no effective requirement that replacement friction product meet the performance standards of the ADRs. Manufacturers do in-house testing, but do not warrant that the product meets the performance standards. Some local manufacturers express strong confidence that their product will meet the performance standards. Some imported product is certified to the ECE/EU standards.

# PRODUCT DESIGN AND DEVELOPMENT FACTORS

The design of asbestos-free brake friction materials is complex compared to materials based on asbestos. The basic elements of design for friction materials for vehicle braking systems are complex in themselves, and there are added complications for the non-asbestos sector.

Asbestos is well understood and offers quite satisfactory performance in most areas – a broad performance band. The physical characteristics are well suited to the environment in vehicle brake systems. There are factors such as high temperature performance (fade) but these are relatively well understood. A limited number of compounds are able to cover market needs. For instance in the light vehicle sector, one friction grade meets most normal needs.

The non-asbestos sector on the other hand is more complex. In the first instance, the technology is at a much earlier stage of development than asbestos based technology, which is relatively mature. The friction materials themselves are more complex – some claim 30 or more ingredients compared to around 10 for an asbestos based component. The performance band is not as broad as asbestos materials, so a wider range of compounds is used to cover the market demands. There have been problems with noise, wear, cold performance, quality and cost. New ingredients are tried to meet particular needs and controlling finished product cost is a continual issue for manufacturers.

One problem is that many of the components used in non-asbestos friction product are expensive compared to asbestos. This is claimed to make it difficult for manufacturers to keep costs down for non-asbestos product. Some local manufacturers dispute this and point to their pricing policy, which is competitive with Australian-made asbestos disc pads. They claim that, in Australia, it should be possible to produce non-asbestos disc pads at competitive prices with asbestos product, and suggest that the market prices for some non-asbestos product lines are inflated.

The team has access to some limited test evidence which confirms that non-asbestos friction product can be developed to meet the performance requirements of the ADRs. There is also the simple fact that new vehicle manufacturers offer non-asbestos friction product in new vehicles. There have been issues in the past, but the European moves to ban chrysotile asbestos show that suitable product can be developed to replace asbestos product in older vehicles.

While this design complexity is a problem for friction material manufacturers, there are consequences in production, storage, distribution and retail flowing from the wider range of different compounds used in non-asbestos components. These factors alone introduce cost penalties.

# INDUSTRY IMPLICATIONS OF A PHASE-OUT OF CHRYSOTILE ASBESTOS

## Industry Structure

The data on industry structure is essentially anecdotal. Quantitative information was sought to provide a clearer picture of the industry structure, but was not available.

Quantitative data was sought on the relative market share of the key players, and within that share, the relative market share of each different type of material marketed. This information was not made available.

Nonetheless, there are some indications of the likely impacts of a phase out of chrysotile asbestos on industry structure. The main sector is replacement components for road vehicle brake systems. The potential effect depends to a large extent on the approach taken by the major local manufacturer. If replacement non-asbestos brake linings are supplied as pre-cut lining sets for rebonding, there will be little impact on the brake service sector. Some major brake bonders who currently import asbestos product will need to develop new sources.

If the manufacturer(s) decided to follow the UK example and supply replacement non-asbestos brake linings as “ready-to-install” brake shoe kits, similar to the practice with disc pads, there would be a significant impact on the brake bonders. Their business volume would decrease markedly, leading to further contraction in the sector. This is a business decision for the local manufacturers. The long standing re-bonding practices in Australia would probably mitigate against such a development.

However, if product quality regulation along the European model is introduced, there could be an issue arising from the need to accept responsibility for the performance of the replacement components. This could lead to a decision to manufacture and supply read to fit brake linings bonded to new brake shoes rather than supply lining materials for bonding to existing brake shoes.

There is also the question of existing stocks of asbestos components. It would be appropriate to negotiate a transition period which would allow for a ‘run down’ of existing stocks. Suppliers suggest 2-3 years would allow clearance of most stocks.

For the road vehicle friction products sector, it is possible to set out some broad implications of a phase out of chrysotile asbestos. These are:

- There would need to be a significant increase in the supply of replacement non-asbestos product to fill the demand currently met by asbestos based product.

- This may lead to investment and production issues for Australian manufacturers, but also increases the market opportunities for producers of non-asbestos product.

- There would also be a need to develop and market non-asbestos replacement brake linings in quantity. This would require development and investment, and could take some time. Developments in UK and the fact that new vehicle manufacturers market asbestos free replacement

linings confirms that the technology is available to produce non-asbestos replacement linings for light vehicles.

- There could be an issue of product rationalisation for Australian manufacturers currently offering asbestos based product. The problem would be in the "specialist" vehicles where numbers are small. The demand would need to be met through imports.

- There could be an industry issue if satisfactory technology for producing bulk replacement lining material is not available. This would lead to issues of product range and processing, given that currently there is a significant supply of asbestos roll for passenger vehicle linings to brake bonders. The outcome could be further shrinkage in the brake bonding sector.

- There would be a need for a consumer education program to support the change to non-asbestos product, and to help customers identify the appropriate product for their operations. This is generally an issue for the light vehicle sector, as the heavy vehicle operators tend to be better informed.

- There would be a need to consider the issues posed by older vehicles, where the volume may not justify the development of non-asbestos product lines. As in the current situation, imports could help fill the gap, with specialist businesses sourcing replacement parts for rare vehicles (as is the case for other components). The European approach offers a potential solution.

This group of implications supports the view that there would need to be a reasonable transition period if a decision was taken to phase out chrysotile asbestos.

Industry would need to have a firm indication of the proposed time scale of a program to phase out chrysotile asbestos. Beyond that time scale, there may be a need for further exclusions for specific areas eg older vehicles or rare vehicles.

# DISCUSSION OF THE ISSUES

## Issue 1 and 2: Replacement Components

To some extent, issues 1 and 2 are mirror images. They both involve the replacement of components using one material with another – asbestos with non-asbestos or vice-versa. The technical issues raised are different, and in some cases market issues are relevant. The following discussion is framed to address the issues in the context of a pragmatic approach to the current situation.

### Non Asbestos Brake Linings for Light Vehicles

Currently the after-market for replacement drum brake linings for light vehicles is largely supplied by asbestos based product. While disc brakes dominate the light vehicle sector, there are still current models produced with drum (generally rear) brakes. There are also many vehicles in the existing car park with disc/drum brakes as well as older vehicles with front and rear drum brakes.

Discussions with brake service operators confirm a perception that replacement non-asbestos linings still pose some performance problems for the owner (noise, poor performance when cold). It is likely that these perceptions arise from a combination of past experience with poor quality non-asbestos replacement product and a lack of "bedding in" of replacement non-asbestos linings. It is well known that replacement non-asbestos linings need to be "bedded in" through several "heavy" applications before the performance potential is achieved. Brake service operators often do not carry out appropriate "bedding in" before the vehicle is collected by the owner. This can lead to a perception by the owner of poor performance, perpetuating the poor image of non-asbestos product.

It is worth noting that one Australian manufacturer did produce non-asbestos replacement product for drum brake linings in the early stages of the development of non-asbestos product. The product performance was not satisfactory, and the manufacturer is no longer in that business.

Because the after-market is dominated by asbestos linings there is little incentive for manufacturers to invest in equipment and product development to market satisfactory non-asbestos drum brake lining materials.

Vehicle manufacturers do offer original equipment (OE) non-asbestos replacement linings for their vehicles, but generally at a price premium. Consultation suggests that vehicle manufacturers hold replacement parts stocks for a relatively long period (over 15 years), but that the parts are progressively centralised as demand slackens. Indications are that while dealers and agents would be required to use OE parts, the broader brake service industry will be inclined to offer customers the choice of asbestos linings as cheaper replacement parts.

As noted earlier, it is understood that Bendix Mintex is developing a non-asbestos replacement lining product line. It is also clear that new vehicle manufacturers source lining material that meets their specifications, and acceptable replacement linings are clearly available in Europe. Thus it can be concluded that the appropriate technology does exist for producing non-asbestos replacement linings and could be used to supply the market in Australia. The issue seems to be more one of incentive and investment.

There are three issues:

- Is it technically feasible to produce satisfactory non-asbestos replacement components in Australia for brake systems designed for asbestos components? The answer to this appears to be clearly yes.

- Is it economically feasible to produce such components for a very small market? This is a question beyond the scope of this study.

- Can the market be satisfied by other means eg import of suitable non-asbestos product or import of defined asbestos product under an exemption process? The answer to this appears to be yes, given the UK approach.

It is possible that the older vehicle market could be satisfied by the import of bulk drum brake lining material specifically for vehicles older than an agreed date. This material could be used through a network of brake bonders along the lines of the existing arrangements. This might raise issues of enforcement and control. The rebonding sector would be much smaller than the current sector. However, if the industry marketed replacement non-asbestos linings as pre-cut sets ready for bonding, the re-bonding sector would still play a significant role. If the industry followed the UK model, and supplied "ready to use" components (linings fitted to brake shoes), there would be a significant contraction in the rebonding sector.

The issues for older vehicles will be quite sensitive in developing a package approach to phasing out chrysotile asbestos.

**The Effect of Warranties**

The extended warranties offered on new vehicles could have some impact on the use of OE or aftermarket parts for brake service. The vehicle manufacturers generally have arrangements in place requiring dealers to only use OE parts to service vehicles. The potential to void warranties would be an issue for dealers and other businesses servicing new vehicles. These issues serve to support the use of OE parts on relatively new vehicles. Given the fact that most vehicle manufacturers moved to non-asbestos friction product in the early 90s, it mitigates, to some extent, against the replacement of non-asbestos parts with asbestos parts while the vehicles are relatively new.

However the issues of warranties and dealer service practices are not directly relevant to the objectives of the study.

## Issue 3: Substandard Product

As noted above, the standard of replacement friction parts is not effectively regulated. Any discussion with industry operators will produce claims of substandard imported parts, generally but not always imported by "hit and run" small importers who quickly move on to other opportunities. The main complaints seem to be poor product life rather than inadequate braking performance. The test data available shows that some replacement disc pads do in fact provide sub-standard performance. There do not seem to be verified claims of actual safety hazards in the field and it is understood that no official action is currently in hand to investigate the issue.

The question of substandard product could become more significant if chrysotile asbestos is phased out in Australia, giving rise to market opportunities for importers of replacement friction products.

The industry has been unable to agree on a simple performance test which would identify substandard product.

This concern has been raised by Bendix Mintex with Government, and industry developed a draft Australian Standard for replacement friction materials. The draft standard is based on the ADRs, and would be expensive to implement. Currently, it is understood that the draft standard is not being progressed.

It has to be recognised that Australian Standards are not compulsory in themselves. There needs to be legislation which calls up the standard to make compliance compulsory eg the Motor Vehicle Standards Act allows the ADRs to mandate compliance with specific Australian Standards called up in specific ADRs.

There are also the mandatory consumer product standards provisions of the Trade Practices Act, which allow specific standards to be made compulsory. The implementation of a mandatory product standard require a comprehensive "justification" process and have not been extensively used in practice.

The concept of the draft Australian Standard is similar to ECE Regulation 90 (and the EU directive). It requires demonstrated compliance with the performance requirements for new vehicles. This would require testing to demonstrate compliance for every model for each product marketed for that model. For a company offering a wide product range, this would be expensive, probably leading to a rationalisation of the product line and price increases.

It is hard to justify implementing the proposed standard for replacement friction materials as a mandatory standard when there is no formal evidence of a safety problem in the field with replacement brake components and there would be cost implications for motorists and operators.

Rigorous implementation of the existing regulatory position under State/Territory legislation would lead to a similar outcome as a mandatory product standard.

It has to be said that this situation is an existing issue and not one that would arise because chrysotile asbestos is phased out. The problem could become more acute if non-asbestos friction materials became the dominant supply in the market. At present, asbestos based friction products occupy a major position in the replacement product market and there is widespread product acceptance. An expanded market for non-asbestos products could attract unscrupulous operators and lead to a significant problem with substandard product.

Another approach would be to consider developing a system of self-regulation for the supply of friction product to the market. Precedents exist in other areas with industry associations taking a significant role. Codes of practice could be useful, and these concepts could be combined with some form of approval or licensing. The success of such approaches relies on a perception of a win-win situation for the participants.

The issue of product standards is significant for several reasons:

- Safety implications.
- Friction material wear rates and replacement frequency.

- Significant cost implications.
- Potential consequent market rationalisation, which could prejudice Australian manufacturing.

## Issue 4: Comparative Test Data for Friction Materials

It is apparent from the literature search and discussions with industry experts that there is little relevant, current comparative test data in the public arena. There is literature on the performance of non-asbestos friction materials, but it is quite old, and would not reflect current technology. Certainly, comprehensive data is not available. Alross, through CVDS, has access to some comparative test data, mainly for heavy vehicles. Some test data has been made available by QFM covering road tests for a range of replacement disc pads. The data supports the view that, today, it is possible to develop non-asbestos materials to meet all the requirements of road vehicle brake systems for new and existing vehicles. This was confirmed in discussions with technical experts. The European/UK regulations also confirm that it is possible to manufacture suitable non-asbestos friction product.

The situation is complicated by the variety of friction materials on offer. Bendix Mintex alone offer seven different non-asbestos disc pad product ranges, each designed for particular service conditions (European, 4WD, high performance, heavy duty and premium or normal city use) and only one asbestos based formulation. One product (Premium) is pitched at a price close to the standard asbestos pads, but the other are priced at a premium.

It is therefore not possible to follow the traditional approach of considering test data to draw conclusions on comparative performance. Some of the data available is contradictory eg the regulatory impact statement for the UK regulations suggests the life of non-asbestos replacement disc pads is 20% greater than that of asbestos pads. Information in Australia suggests that the life of non-asbestos disc pads (and disk rotors) depends on the type of material used. Some have a long life and some have a shorter life than asbestos components.

The “fit for purpose” provisions of the Trade Practices Act could be relevant. Reputable suppliers would be aware of the requirements of the Act, and would carry out sufficient testing to ensure that their product was fit for purpose. This would often not extend to a full ADR test, but it does give some assurance of reasonable product performance. A logical extrapolation would be that there would need to be some system in place to control the import of components to guard against the import of substandard product. There might be possibilities to link these arrangements to a relatively simple consumer product standard. Enforcement would remain an issue.

The European experience and the current moves to ban chrysotile asbestos also provide some confidence that satisfactory non-asbestos product can be developed. These actions are based on the availability of non-asbestos replacement parts, which are satisfactory in terms of performance and economics. The major replacement component suppliers have access to European components – some are already imported – and Bendix Mintex has links to international companies and these links should allow access to relevant technology. This should allow Australian manufacture of replacement non-asbestos components across the range, given time. There could be some product line rationalisation, but the market demand would see imported replacement parts fill any resulting gaps.

It is worth noting that the internationalisation of the vehicle (and component) manufacturing sector has led to the production of quality vehicle components in many countries. The quality of components can be demonstrated by compliance with the UN/ECE standards through the international system of testing and conformity of production assessment. This process applies to friction materials and there are replacement friction material components from non-European counties which are certified to the UN/ECE standards. The point is that there are multiple sources of replacement components and there are processes which can ensure quality and performance – at a cost. There are also multiple sources of poor quality cheap components and the question is whether Australia should put in place measures to regulate this area. This question is outside the scope of this project.

There would be a need to give industry sufficient time to produce non-asbestos friction product, particularly for drum brake linings. The wide use of asbestos product to replace non-asbestos components in the field would also suggest a need to significantly expand production/import of non-asbestos disc pads and heavy vehicle brake blocks. There is also the issue of allowing a reasonable time for the run down of existing stocks of asbestos components. Reasonable time scales would need to be developed in consultation with industry, with the longer time-scale likely to be that needed to increase/establish production of non-asbestos components. Discussions suggest a time-scale of 3-5 years might be appropriate, but this would need to be formally confirmed with the stakeholders.

The key point is that there are currently no effective incentives in place in Australia to encourage the use of non-asbestos replacement parts, or to discourage the use of asbestos replacement parts. The UK regulations provide for “commencement of proceedings” in the case of a contravention of the regulations.

## Issue 5: Wide Range of Product Available in the Market

Given that the performance range of non-asbestos friction materials is not as broad as that of asbestos product, it is not surprising that there is quite a wide range of non-asbestos product formulations offered in the market.

Bendix Mintex, for example offer seven different non-asbestos pad formulations, each with specific characteristics. They also offer a comprehensive range of asbestos based replacement pads. While Bendix Mintex is confident of the quality and performance of their product, they do not claim to have tested aftermarket product against the performance requirements of the new vehicle ADRs in all cases. This is due to the large number of product lines and the consequent high cost of a comprehensive ADR test program for all product.

The most comprehensive range of Bendix Mintex replacement non-asbestos brake pads - the Metal King Plus - is a semi-metallic compound that is well suited to heavy duty cycles such as city driving (couriers and taxi) and larger cars and light commercial vehicles. It performs well and gives a long life. However, it would generally give a higher pedal pressure in family cars and could lead to customer reaction in normal suburban use. For many models, where other materials are available, the Metal King is not the recommended replacement pad. For some vehicles, where the vehicle was designed with semi-metallic pads, the Metal King is the recommended pad.

Bendix Mintex has now introduced a new line – the Premium – specifically targeted at normal family vehicles and competitively priced with asbestos based pads. The new line is currently focussed on popular models and does not cover the range of the Metal King line. Bendix Mintex also offers a 4WD product line, a Euro-pack line,

a Taxi-pak line and high performance lines – Ultimate and Performax. These lines are offered for a more restricted range of vehicles.

In the current Australian market, the issue is that an owner may choose from a range of replacement pads, but often does so solely on price, thus choosing asbestos based product. There is limited information available to the customer, although the companies do attempt to provide some guidance.

It is interesting to note that in spite of these issues, there does not seem to be a consumer or a safety concern arising from the use of replacement disc pads which may not be best matched to the vehicle and/or its use.

# FRICTION PRODUCTS IN OTHER SECTORS

The NICNAS report found that friction materials for railway equipment were no longer based on asbestos. This has been confirmed in consultation.

In the general industrial sector there is a range of mobile equipment using friction materials for braking systems. There is also wide use of friction materials in other machinery for wet and dry clutches and for speed control. Discussions with suppliers reveal a similar situation to that for friction product for road vehicles. There is a strong move to use non-asbestos components in new product, and there is widespread availability of non-asbestos replacement product. However, there is also some field prejudice in favour of asbestos product, and against non-asbestos product.

Suppliers suggest that it is possible to use non-asbestos in virtually all applications, but customers often ask for asbestos product when servicing equipment. In a competitive market, many suppliers feel obliged to offer asbestos product. Bendix Mintex, for instance, supplies imported non-asbestos woven roll material. Some suppliers no longer carry asbestos product.

It is reasonable to conclude that the market is moving strongly to phase out asbestos product in favour of non-asbestos product. There is no statutory performance regulation similar to the ADR system, and many uses do not pose public risk.

In the aviation sector, new planes all use non-asbestos friction materials. There are a number of light aircraft in-service which originally used asbestos based friction materials in the brake system. In the tightly regulated aviation sector, the brake friction materials can only be replaced by an “approved” component. In other words, the supply of replacement components is tightly controlled, and the issue of poor quality components is unlikely to arise.

An analysis of the aircraft register suggests that 93 % of the light aircraft on the register are US or EU origin. The remainder would be from Eastern Europe, South America, Japan and Australasia. These aircraft would mostly be certified to US or EU standards and non-asbestos friction materials would also be available for many of the aircraft.

The replacement components are predominantly imported, and discussions with a major supplier for US sourced light aircraft suggests that non-asbestos replacement components are already available for most light aircraft. When this is taken together with developments in Europe, it is likely that the issue of asbestos replacement parts for light aircraft will reduce to a very small number of rare aircraft. Such cases could be dealt with on an individual basis.

There are a number of other components using asbestos in aircraft eg high temperature clamps and spacers in jet engines. This will also be likely to require an exemption process. The UK regulations confirm that there are a range of components in aircraft which continue to use asbestos based product and are considered essential to safe operation. It was not possible to identify individual components in the timescale of the study. The lack of industry response could be taken to indicate that the issue is not seen as critical by the industry ie suitable replacement materials are available or in prospect.

## OTHER INDUSTRIAL USES OF ASBESTOS

There are a wide variety of components based on the use of asbestos alone or in combination with other materials eg rubber compounds, thermosetting plastics. A sample review of selected companies importing friction products for industrial uses suggests that non-asbestos products are widely used in situations where, historically, asbestos based materials were used.

The NICNAS report identified one Australian manufacturer who imported raw chrysotile asbestos, Richard Klinger Pty Ltd, specialising in gaskets and seals. Klinger noted that with proper design, all the joints and seals in refineries and industrial equipment could be made with non-asbestos materials. Broader consultation suggest that this is the case. Replacement of high stress seals with non-asbestos material needs to be done with proper engineering to ensure that performance is not prejudiced. In general, there may be cost penalties, particularly in the early stages of the use of substitutes. As technology improves and production builds up, costs should fall. There is a move to phase out the use of chrysotile asbestos in new equipment, and some large companies have this policy in place.

It is worth noting that Richard Klinger advises that currently, the company does not actively market chrysotile asbestos product and only produces the product to meet existing contracts. The company expects that the supply of asbestos product will end in 12-18 months.

The literature confirms that it is possible to redesign high stress joints and seals to successfully use non-asbestos product. It also confirms the need for proper engineering design to ensure that safety performance is maintained. Richard Klinger provides expert advice to help customers move to non-asbestos products.

The fact that some major operators in the petro-chemical sector have moved to specify non-asbestos components in new equipment, confirms the technological reality. However, it may be necessary to negotiate appropriate transition arrangements for existing plant (high temperature and pressure operations with dangerous chemicals), as part of a phase-out of chrysotile asbestos unless reliable and economic substitute components are already available. This may reduce to an economic issue, as the evidence suggests that suitable non-asbestos substitute materials are available.

The NICNAS report also identified Vivacity Engineering as a small user of raw chrysotile asbestos. Vivacity manufactures special purpose adhesive mainly for export with some local sales. Vivacity advises that non-asbestos adhesives are under development and are expected to replace the asbestos based product.

The NICNAS report identified components in jet engines which use chrysotile asbestos as one component of a composite. It was not possible to obtain definitive information on these issues from the manufacturers, but there was a general comment that asbestos bound components are no longer used. The issue is the maintenance of existing equipment, and there may be a need to negotiate exclusion where ‘approved’ substitute non-asbestos components are not available. Again, regulation in the aviation sector will require the formal ‘approval’ of non-asbestos replacement components.

The most compelling argument in support of the phase out of chrysotile asbestos in industrial uses comes from the fact that the EU and specifically UK, have moved to

ban chrysotile asbestos. The UK regulations allow a number of temporary exemptions for specific areas where there was seen to be a need to allow time for the transition.

It has to be recognised that there has been a very strong move by industry in those countries to develop non-asbestos and some EU member countries have had bans on the use of chrysotile asbestos for some time. UK has had regulations in place since 1987 requiring asbestos substitutes be used where technically feasible. Consequently the development work has been done and there is obvious confidence that non-asbestos components are available or can be developed to provide the required performance.

Attachment 5 canvasses these issues in more detail.

# EXCLUSIONS

For the purpose of this study, exclusions are defined as those uses of chrysotile asbestos where continued use is recommended. Exclusions need to be considered in the context of a negotiated transition period to allow industry to move to phase out the use of asbestos based product. A negotiated transition period is necessary to recognise the Australian situation where the use of chrysotile asbestos based product is quite widespread across industry. The transition period would need to allow for:

- run-down of existing stocks of asbestos components
- the development and marketing of new product
- expansion of existing non-asbestos product supply to meet the increased demand.

The discussion above identifies a number of potential exclusions. Some are based on economic considerations, including market and investment issues, while others are based on technical considerations. The EU/UK model suggests that there is only one use of chrysotile asbestos where there is a substantive technical case for potential longer term exclusion – diaphragms for use in chlorine plants. However, industry advises that this is not a problem in Australian plant.

There is also one case, based on economic grounds, for a longer term exclusion – friction materials for older (pre-1973) vehicles.

The negotiation process to determine the general transition period should be inclusive and allow an opportunity for manufacturers, importers and users an opportunity to argue the case for their particular interest. This negotiation process could also encompass the determination of specific exclusions. It is important to note that specific exclusions should be subject to review to encourage the development of substitute materials and components. The UK model provides guidance in this area.

The suggested potential exclusions are largely based on the UK model. The significant difference is that there is currently widespread use of chrysotile asbestos product in Australia, particularly for road vehicle friction materials. Hence the need to negotiate a general exclusion for products using chrysotile asbestos while industry restructures and develops the capacity to supply non-asbestos product.

In other words, by the time the general exclusion expires, specific exclusions might no longer be required. It has to be recognised that Australia is in a position to benefit from international developments in non-asbestos replacement materials, and consequently it should be possible to develop a minimal specific exclusion list based on industry consultation.

The potential exclusions are:

- A general exclusion to cover all current uses of chrysotile asbestos. The time period would be negotiated with key stakeholders (3-5 years).
- A specific exclusion for road vehicle friction materials (if necessary) to cover the need to develop the capacity to produce sufficient non-asbestos product to meet the market needs. Again this would need to be

negotiated with the relevant stakeholders, and might be longer than the general exclusion.

- A specific standing exclusion for friction materials for older vehicles. The date suggested in the EU/UK model (pre 1973) would serve as a useful starting point for negotiations with the stakeholders.

- For the following categories, specific exclusions might be necessary to deal with claims that the time period of the general exclusions might not allow sufficient time for the development of satisfactory replacement product. The categories are drawn directly from the UK Regulations:

    - compressed fibre gaskets for use with chlorine

    - compressed fibre gaskets in general sheet with a density greater than 1900 kg/mcubic metre and for use above 500°C

    - any component of a helicopter or aeroplane which is necessary for its safe operation

    - any product used in vanes for rotary pumps or compressors, bearings or housings and split face seals for electricity generation plants

    - steam boiler door joint seals

    - personal protective clothing for use above 500°C

    - diaphragms for use in electrolysis

    - receptacles for the storage of acetylene gas, in use before 24 November 99.

Again, it should be emphasised that the time-scale of specific exclusions might well fall within the time period of the general exclusion, and separate exclusions might not be necessary.

# FINDINGS

This section summarises the findings canvassed in the discussion above.

The main findings are:

- That technology is available to allow the production of non-asbestos replacement friction materials for road vehicles. This includes replacement linings for drum brakes.

- There would be a significant impact on the Australian marketplace for replacement friction products if components based on chrysotile asbestos were phased out in too short a time scale.

- There is no effective regulation of the quality of replacement friction products in Australia. The European model would impose significant costs on consumers.

- For older vehicles, where the market is small, there may not be the incentive to develop replacement non-asbestos brake linings. Some form of exemption along the lines of the British model may be required.

- In the tightly regulated aviation sector there are a number of light planes using asbestos based brake components. While non-asbestos components are available for most planes, some form of exclusion might be necessary for rare types.

- Chrysotile asbestos based components are quite widely used in industry. While non-asbestos components are available for many uses (eg friction products), the situation is not as clear for some other areas. The components would mostly enter Australia as part of machinery, and would not be visible to the Customs system. European experience suggests that given reasonable time, substitute non-asbestos components can be developed for virtually all uses.

- If the use of chrysotile asbestos were to be phased out in Australia, there would be a need to put appropriate regulation in place, with a reasonable transition period. The regulations would provide the incentive for the development/sourcing of suitable replacement components and the time-scale would allow for the run-down of existing stocks and the development of new/expanded capacity to provide for the increase in demand for non-asbestos product. A transition period of 3-5 years may be required.

- There would be a need for some exclusions, but there should be a review process, which would provide an opportunity for industry to argue the case for continued exemptions if no satisfactory substitute had been developed. The number of exclusions would be relatively small, given a reasonable transition period.

# STRATEGIES

The findings of this report suggest a strategy to move ahead with phasing out the use of chrysotile asbestos in Australia. The NICNAS Report identified three importers and processors of raw chrysotile asbestos fibre in Australia. The main use of imported raw chrysotile asbestos fibre in Australia is for the manufacture of replacement brake friction product for road vehicles by Bendix Mintex. The second use of raw chrysotile asbestos identified in the NICNAS study was by Richard Klinger Pty Ltd for the manufacture of flat sheet for seals and gaskets. That company advises that it is moving to stop processing raw chrysotile asbestos in Australia. The third user was a small company making specialised adhesive, largely for export.

There are a number of industrial users of imported product containing chrysotile asbestos, generally in specialised equipment or production facilities. These users include the aviation industry. The components, apart from seals, are generally contained in a composite with resin or some other binder. There is the issue of safe disposal of used components.

In practice, the situation today is that Bendix Mintex is the only significant importer and processor of raw chrysotile asbestos fibre in Australia. There are other importers of replacement friction product containing chrysotile asbestos and other products containing asbestos.

The significant issue reduces to the use of chrysotile asbestos in replacement friction product for road vehicles. A program to phase out the use of asbestos product for replacement friction product for brakes would address the major issue in relation to occupational health and public health. Such a program would need to recognise the realities of the Australian brake service sector as well as the need for time for industry to develop the capacity to produce sufficient non-asbestos replacement product to meet the expected increase in demand as asbestos product is phased out. Australian production would, as now, be supplemented by imports.

There are two important aspects of such a program. The first aspect is the import of raw chrysotile asbestos fibre. This could be banned through the Customs procedures under public health grounds. The timing of the implementation of the ban could be negotiated with industry. There could be an exemption for the one other Australian processor for a period to allow the development of alternative materials for that product.

There is also the need to allow time for other uses of chrysotile asbestos in Australia to be phased out. Again a Customs process with an agreed implementation date could be the vehicle. It may be that one general time period would meet both needs.

The question of imports of replacement friction product containing chrysotile asbestos would need to be addressed. Two models that could be pursued are:

- Follow the UK example and put in place regulations banning the use of chrysotile asbestos product for replacement brake friction components. While this is effective in UK, with a single national government, the powers to deal with replacement parts in Australia are understood to be with the State/Territory Governments. It would be necessary for legislation to be passed in each jurisdiction, and this has historically posed problems. It would also be necessary for the regulations to be

drafted to cover the supply or possession (and perhaps the offer to supply) of chrysotile asbestos product along the lines of the UK Braking regulation. The existing State/Territory regulatory framework for vehicles in-service is essentially restricted to the owner/driver, and does not encompass the supplier.

An alternative approach might be to explore the Trade Practices Act provisions related to mandatory product standards. If chrysotile asbestos is deemed to be a public health issue, it might be possible to develop a product standard which sets out that products are not allowed to contain chrysotile asbestos. The difficulty is that very few mandatory product standards have been put in place and this would not be a traditional product standard. However, this approach would offer a "national" approach.

- The second approach would be to again resort to the Customs powers and ban the import of replacement friction product containing chrysotile asbestos. This could be combined with a general ban on the import of product containing asbestos, with exemptions set out in a schedule. The exemptions could follow the European model with time limits to provide incentive for the development of non-asbestos product and a specific exemption for older (say pre 1973) vehicles.

The second approach would raise issues of administration. There may be a need to provide a link to other legislation which would provide the powers to administer the exemptions. The linkage between the Motor Vehicle Standards Act 1989 and the Customs Act provides a model. There is also the issue of Federal State/Territory relations to be considered.

# CONCLUSIONS

There is strong evidence in Australia and overseas that non-asbestos friction product can be developed to meet the requirements of vehicle braking systems. The specific issue of replacement friction parts for older vehicles would need to be addressed. The issue is one of economics rather than product development.

There are a wide range of other uses of chrysotile asbestos in industry, including gaskets and seals. Consultations reveal that there is already a move to use non-asbestos product in new applications. Research confirms that there are suitable replacement materials available for all applications identified. There may be a need to re-engineer applications and some cost penalty.

It has to be recognised that there is currently widespread use of chrysotile asbestos product in the vehicles sector and in the industrial sector. Consequently, a transition period would be needed to allow for industry to dispose of current stocks and develop the capacity to supply non-asbestos product to meet all requirements.

Discussion suggested a period of 2-3 years would allow a run-down of asbestos component stocks, while a period of up to five years would allow for the development of additional capacity to supply the demand for non-asbestos product.

For existing applications, the research suggested that suitable replacement materials are available, again requiring re-engineering in some applications and the possibility of a cost penalty.

It is important to note that there may be applications that were not identified in this study. The process of negotiating a transition period and exclusions should allow for the possibility of the identification of further uses of crysotile asbestos based materials which may raise new issues. On the other hand, experience overseas suggests that it is unlikely that major new issues would be identified.

From the above discussion, Australia could, with some confidence, move to phase out the supply and use of chrysotile asbestos. There would be a need to negotiate an appropriate transition period with the stakeholders and there are a small number of areas where some longer temporary exclusions might be necessary. There would also be a need to provide an exclusion for older vehicles, on economic rather than technical grounds.

# ATTACHMENT 1

# LIGHT VEHICLE BRAKING

## Background

For the purpose of this report, light vehicles include passenger cars, 4WD, light commercial vehicles, forward control passenger vehicles and small buses. The coverage also includes the bottom end of vehicles classified as medium goods vehicles and two and three wheel vehicles. The vehicles would all have disc or drum brakes, hydraulically operated and in many cases with power assistance. The relevant ADR's are ADR 31, ADR 33, and for commercial vehicles, ADR 35.

It is significant in the context of the market for replacement parts to note that the Australian new passenger vehicle market is one of the most competitive in the world with some 30 manufacturers represented, offering over 300 different models. Given that four manufacturers offer some 20 model designations manufactured in Australia, it is not surprising that there is a very wide range of replacement friction brake components to be covered. This also raises questions of economics for Australian manufacturers in covering the product range.

In this sector, disc brakes are the most common braking system for new passenger vehicles, 4WD and light commercial vehicles. Drum brakes are still offered on some of the cheaper passenger vehicles (rear axle only), representing an ever declining sector. For goods vehicles, drum brakes with power assistance are the norm, with disc brakes only now becoming available, generally restricted to passenger or specialist vehicles (fire engines).

Industry advises that all new vehicles are offered with non-asbestos brake friction materials, including those with drum brakes. This has two consequences:

- Manufacturers stock non-asbestos replacement components for brakes – disc and drum
- The after-market offers a wide range of non-asbestos brake components for these vehicles.

The inference that can be drawn from this is that it is possible to develop satisfactory non-asbestos friction materials for both disc and drum brakes. This is confirmed by recent regulation in Europe, which requires non-asbestos replacement components. However, the largest brake component manufacturer in Australia does not currently offer non-asbestos materials for light vehicle drum brakes, reflecting a combination of production issues and market realities.

There have been problems with early non-asbestos friction materials for light vehicles eg noise, wear and braking performance. Much of the development work on non-asbestos friction materials has been on reducing what might be categorised as perception problems – noise, feel and smell, as well as wear and performance problems. There is strong evidence in Australia and overseas that these problems have been successfully addressed today. However, as noted elsewhere, there remain strong views in the service sector in favour of asbestos based replacement parts.

The common practice of replacing non-asbestos friction materials with asbestos components has its origin in the early period of non-asbestos materials. There were problems with early non-asbestos materials in Australia, both in terms of life and performance. This early experience, combined with the higher cost of non-asbestos components, has meant that it is common practice for non-asbestos components to be replaced with asbestos components during service. This practice continues despite clear evidence in many cases that non-asbestos friction materials give satisfactory performance combined with a longer life which more than offsets the initial cost premium.

After-market suppliers are generally obliged to market asbestos components to meet the customer demand, even when they offer more cost-effective non-asbestos product. This is typified by the product list of Bendix Mintex for disc pads. The product line offers both asbestos based and non-asbestos replacement disc pads for light vehicles and brake blocks for heavy vehicles. The anomaly is replacement drum brake linings for light vehicles, where Bendix Mintex only offers asbestos based product. This reflects both the market reality and the fact that Bendix Mintex current processes for producing light vehicle linings may not be well suited to producing non-asbestos linings. The relevant technology does exist within the international parent group of Bendix Mintex, as non-asbestos linings are produced by the group for the after-market in Europe and other markets. Non-asbestos linings are also produced by the OE suppliers to the vehicle manufacturers.

There are smaller disc pad manufacturers in Australia who specialise in non-asbestos product. These manufacturers are confident that their product will meet the performance requirements of the ADRs, and hold test evidence for some vehicles to support their claims. These manufacturers do not cover the full range of product offered by Bendix Mintex, but do cover a wide range of vehicle models.

## The Brake Service Sector

The brake service sector is very diverse and widely dispersed. A simple Internet search reveals over 300 businesses specialising in aspects of brake service. To this must be added the service operations of new and used vehicle dealers, the service operations of large fleet operators and some chain stores, service stations and individuals who do their own service. The operations vary from individuals to units of very large organisations.

The light vehicle brake service sector today is very different to that of the seventies and eighties. There has been a marked shift to disc brakes, with replacement components supplied as ready to install sets. This has had a major impact on the brake bonding sector (drum brakes), with significant rationalisation taking place. As disc brakes become more dominant, the bonding sector will shrink further.

Brake bonders today are often supplied with pre-cut lining material, generally ready for bonding (no rivet holes). There is still some material supplied in bulk, with the linings cut to size in the bonder's workshop. Bonders supply exchange brake shoes for popular models and for less popular models, new linings are bonded to the existing brake shoes. In either case, the shoes have to have the worn linings taken off and are then cleaned and prepared for new linings. This is different to the heavy vehicle sector, where riveted linings are still common.

While it is possible to remove worn friction material from disc pads in preparation for new friction pads, this is not common and is generally restricted to specialist vehicles. This probably reflects the relatively simple (and cheap) structure of disc pad backing plates compared to brake shoes, and the fact that the new pads are supplied moulded on to the backing plate. There is no market in Australia for

separate disc friction pads, unlike US where it is still common to rivet disc pads to backing plates. Some small manufacturers of after-market disc pads will mould new friction material to used disc backing plates, but only for special cases. Small manufacturers will also manufacture very small orders for specialist vehicles, usually on a fully costed basis.

Discussions with operators, suppliers and brake service businesses reveals that the prejudice against non-asbestos materials is still commonplace, even when it can be shown that non-asbestos replacement components are more economic and offer excellent performance. Large organisations such as major bus and transport operators tend to use non-asbestos materials due to a combination of economics and workplace issues. Smaller operators and individuals tend to be more influenced by prejudice and initial cost.

There is a continuing issue of product quality in the marketplace. Both asbestos and non-asbestos product suffers or has suffered from poor quality components offered in the market. There is no effective regulation of the quality of replacement friction product in Australia, and discussions with importers reveal that consistent product quality is an issue, as well as imports of poor quality cheap components. The poor quality components are generally imported by opportunistic importers, although there have been instances of reputable importers supplying poor quality product.

For the light vehicle sector, the key issue is the fact that the major Australian manufacturer of vehicle friction product does not produce non-asbestos brings for light vehicles. The company advises that it is planning to produce non-asbestos linings but the time scale is unclear.

If asbestos product is to be phased out, there will obviously need to be a transition period to allow producer(s) to move to non-asbestos product. The time scale would need to be negotiated, and may be longer than that needed to allow for the run-down of existing stocks of asbestos components.

# ATTACHMENT 2

# HEAVY VEHICLE BRAKING

This attachment canvasses a range of issues in relation to heavy vehicle braking, and the use of non-asbestos replacement product in heavy vehicles. The discussion is based on extensive experience is the heavy vehicle sector, including certification and testing of heavy vehicle brakes. This experience was supplemented by a telephone survey of a range of key operators in the heavy vehicle sector.

## Current Market Structure

### New Vehicles

Sales of trucks with a GVM in excess of 3,500 kg in Australia for the 1999 calendar year totalled 19,397 units. This was made up of:

Light duty (3,500 kg to 7,500 kg):

7606 units, imported from Japan (86.2%), Korea (11.0%), Europe (1.5%) and USA (1.3%)

Medium duty (7501 kg to 15,000 kg):

5540 units, imported from Japan (94.8%) and Europe (5.2%)

Heavy duty (>1,500 kg):

6,251 units, Australian CKD or SKD assembled, USA or European source (56.4%), imported from USA or Canada (19.7%), Europe (8.2%), Japan (15.4%)

Bus and coach chassis sales for 1999 totalled 959 units. These were sourced from:

Europe (76.6%), Japan (14.8%), Australia (5.6%), USA (1%) Korea (0.8%) unidentified (1%)

In Europe, the USA and Japan, non-asbestos brake linings are either mandatory or have been adopted on a national industry basis as the industry standard since approximately 1993. Vehicles or CKD kits originating from these countries will therefore be fitted with non-asbestos brake linings

Australian manufactured trucks and bus chassis use steer and drive axles imported from the USA complete with brakes which are fitted with non-asbestos friction grade FF linings.

Trailers with a Gross Trailer Mass exceeding 4.5 tonnes, apart from a small number of special-purpose plant trailers, are manufactured in Australia using axles certified as approved subassemblies under ADR 38/02 procedures.

When ADR 38/02 was introduced in July 1998, the fade test procedure was amended in a manner that forced almost all axle suppliers to retest their brakes to the revised fade test procedure. With the exception of one light trailer axle manufacturer, all suppliers used the enforced retesting requirement as an

opportunity to change from asbestos to non-asbestos brake linings. In most cases, no change was made to the brake other than to change the lining block composition, and the retested brakes met all ADR 38/02 requirements.

Only two trailer axles, one rated to 3 tonnes and the other to 5 tonnes, were identified as continuing to use asbestos-based brake linings as original equipment. All other heavy motor vehicles and trailers, at the time of initial supply to the market, use non-asbestos brake linings.

### Replacement / After-market

No accurate statistics on the relative proportion of asbestos to non-asbestos brake lining sales volumes were located for replacement brake linings.

The larger transport fleets and bus fleets contacted, almost without exception reported that they had standardised on non-asbestos replacement linings, for Occupational Health and Safety (OHS) reasons on average at least 8 years ago. While some fleets insisted on use of the original equipment linings to ensure continued ADR compliance, others reported sourcing of quality certified non-asbestos linings of similar friction grade, directly from wholesale importers.

Brake repair and retail sales outlets generally reported selling more asbestos linings that non-asbestos, with the proportion of non-asbestos linings slowly increasing but still considerably less than 50% of total. These outlets tend to cater for the large number of private operators or small fleets.

Disc brake use is confined to the front axles of the light duty segment of the market, on vacuum assisted hydraulic brake systems. In the medium duty segment, brakes are predominantly air assisted hydraulic or full air drum type, either wedge or S-cam. The heavy vehicle segment uses predominantly S-cam drum brakes, with air disc brakes starting to make an appearance.

Replacement linings are sold as pre-moulded and drilled brake block sets with loose attaching rivets, to be riveted to the existing shoes by a maintenance workshop or specialist brake repair shop, or alternatively as exchange, pre-fitted shoes and linings.

When the usage of large fleets is combined with the estimates from the retail suppliers, it would seem that considerably more than half of the national heavy vehicle fleet would be operating with non-asbestos brake linings

## Alternatives

### Other materials and sources

In asbestos-based brake linings, asbestos fibres typically constitute 20% to 50% of the lining block weight. In asbestos-free linings, this fibre content is replaced by a combination of organic and inorganic fibres, selected to achieve a desired balance between conflicting factors such as friction coefficient, thermal stability, wear rate, material strength, noise generation, drum or disc wear, thermal conductivity, ease of processing and cost.

Typical fibres used in drum brake blocks are aramid (kevlar), glass, copper or brass, carbon, rock-wool, ceramic and potassium titanate.

The wide range of alternative fibres and the wide differences in properties and cost result in far greater variability in cost and performance within the generic "non-asbestos" spectrum than was the case with asbestos-based linings.

This, together with durability and high drum wear problems with some early non-asbestos compounds, has tended to create an inaccurate, adverse image for non-asbestos brake linings in the minds of many vehicle operators.

Non-asbestos replacement linings were reported as being sourced from Brazil, Thailand and Malaysia as well as USA, Europe and Australia. The better quality linings from Brazil brought in by importers such as Frasle and Taro carry quality markings from independent certification agencies such as TUV (Germany) and are the standard replacement lining for some of the nation's largest urban bus fleets.

Non-asbestos brake linings have been readily available for heavy vehicles for at least 13 years. The major brake and axle supplier to the Australian truck assembly industry, Rockwell International, commenced in 1987 to supply axles with Abex ABB 691 162 non-asbestos brake lining material, and this lining has remained the standard OE material for Australian assembled USA-based trucks and buses to the present time.

OE linings sold by the vehicle manufacturer's service outlets are generally sourced from the country of origin of the vehicle, although most OEM service outlets also sell lower cost non-OE lining sets to remain competitive in the market. This is different to the light vehicle market, where manufacturers offer only OE parts.

## Issues

### Performance

A comparison of ADR38/02 certified trailer axle performance torque figures with previous asbestos lining versions of the same axles shows that torques have either remained similar or at most have reduced by 10%. In most cases, the only change made to the axles prior to retesting to the altered ADR 38/02 fade test conditions was to change the lining compound.

ADR 35/00 and 35/01 test data does not allow a similar comparison of brake output torque because of the variability of control pedal force permitted by the test procedure. An examination of ADR 35/01 brake test records from the time of introduction of non-asbestos brake linings shows that, compared with the previous asbestos based linings, the non-asbestos linings required considerably more pre-test burnishing before consistent brake performance and adequate fade test results could be achieved. However, once bedded in and heat-conditioned, there appears to have been little difference in the recorded performance of the linings, and the minimum specified deceleration requirements were generally met with a comfortable margin.

In some cases, the initial performance of the lining material was quite poor, and the linings appeared to require working to an elevated temperature before adequate and consistent performance was achieved. One air disc braked heavy truck required four successive ADR 35/01 fade conditioning sequences before the brake pads reached their full operating potential.

A perception of superior performance from asbestos linings was consistently reported by the retail brake lining sales outlets. Negative customer reaction to non-asbestos linings and brake block cracking around the rivets on some early non-asbestos material were cited as reasons for a continued preference for asbestos

material. As an example, one workshop quoted experiences with non-asbestos original clutch lining disintegration on Japanese mid-range trucks in arduous service, which could be rectified by relining with asbestos based material.

The large urban transit city bus fleets in general could not provide any comparison between asbestos and non-asbestos brake performance because they had changed to non-asbestos material for Occupational Health and Safety (OHS) reasons on average at least 8 years ago. Fleet maintenance managers surveyed could recall some early problems with life and brake noise, but stated that current materials gave satisfactory performance.

Maintenance managers for large line-haul semitrailer operating freight companies also expressed satisfaction with the performance of non-asbestos linings.

**Wear**

A continued preference for asbestos based brake linings over non-asbestos was expressed by many of the small fleet operators surveyed. The preference was based, not so much on the lower initial purchase price of asbestos linings but more on a perception that asbestos linings gave better performance and considerably longer life than non-asbestos linings.

As an example, one tipper fleet operator with 32 truck/dog trailer combinations quoted, for trailers operating in city traffic, figures of 50,000 km for the non-asbestos linings supplied on new trailers introduced to the fleet, and 80,000 km for the same trailers relined with asbestos linings. For trailers operating on-highway, indicative figures were 120,000 km for new equipment and 250,000 km when relined. The maintenance cost savings were felt to more than offset the additional cost associated with handling and disposal of asbestos material.

No difference in brake drum wear was reported for asbestos and non-asbestos linings by all operators surveyed.

The consensus of opinion from suppliers and users was that non-asbestos brake lining material had improved significantly since the earliest compounds.

**Noise & other issues**

No adverse comments were reported regarding braking noise generation by asbestos replacement materials. One urban bus fleet maintenance supervisor reported that early brake noise problems had been traced to the relatively coarse machining of commercially available brake drum friction surfaces, and that better machining of the drums had eliminated the problem

## Older Vehicles

There are similar economic issues which may lead to a need to provide some exclusions for older vehicles. There are still commercial vehicles over 20 years old in use today. There may not be the volume to support the economic development of non-asbestos brake components for these vehicles where they use unusual size brake drums – diameter or width. Similar provisions to those proposed for light vehicles may be necessary, with the cut-off date negotiated with the parties.

## Options

While there was still a perception amongst a sizeable proportion of the smaller private operator segment of the heavy transport industry that asbestos linings gave more reliable and economical performance than non-asbestos equivalents, there was general acceptance that non-asbestos brake linings could, at some operating cost penalty, be substituted with no safety implications.

## Conclusions

No technical or safety reasons exist to prevent the eventual replacement of asbestos brake and clutch linings in the heavy transport industry in all but very old vehicles. The experience in Europe, Japan and the USA has demonstrated the feasibility of the elimination of asbestos-based friction materials from the heavy road transport industry.

It is likely that some increase in operating cost would result for vehicle owners who are currently still using asbestos linings. Quantification of this possible cost increase was beyond the scope of the brief for the current exercise.

It is noted that, even in Europe where asbestos use in brake linings has been phased out, exemption is given for asbestos linings to be used in pre-1973 vehicles where tooling for replacement moulded non-asbestos linings would be uneconomic.

# ATTACHMENT 3

## ISSUES IN DEVELOPING NON-ASBESTOS FRICTION MATERIALS

This section is intended to set out some broad issues in developing friction materials, and as far as possible, current trends.

There is little contemporary literature on the development of non-asbestos friction materials. The published literature is generally of the period late 80s to early 90s and does not give a current appreciation of the situation. This discussion is drawn from literature of the early 90s and discussions with manufacturers which give some indications of current developments. The availability of product in the marketplace and on all new vehicles suggests that the early problems have been addressed successfully.

The basic principles of brake system design have been unchanged by the shift to non-asbestos friction product. In the heavy vehicle sector, where model cycles are often quite long, is evidence that the vehicles braking systems were re-certified to ADR 35 with non-asbestos brake blocks without any consequential change to the brake system. In the light vehicle sector, re-certification generally followed model cycles, and the same data is not available. However, limited test data available to the team and anecdotal evidence suggests that the change to non-asbestos friction product did not directly lead to brake system design changes.

The main driving force behind brake system design for light vehicles has been directed to reducing unsprung weight and to some extent higher levels of vehicle performance. Paradoxically, this had led to a more extreme environment for disc pad materials as surface area and mass were reduced. These more stringent operating conditions have all been met using non-asbestos product. For heavy vehicles, the issue has generally been related to load and speed/power increases and consequent heavier demands on the braking system.

The early developments in non-asbestos friction materials were focussed on disc brakes. This was the main growth area, while drum brakes form a declining sector for light vehicles, particularly passenger vehicles.

The key characteristics of friction materials are:

- Friction coefficient, including temperature performance (fade characteristics)
- Wear rate
- Damage to the rotor/drum
- Noise and judder
- Thermal conductivity
- Strength and durability

There is a range of common components of non-asbestos friction materials:

| **MATERIALS** | | **FUNCTION** |
|---|---|---|
| RESIN | Phenolic, Epoxy etc | Binder |
| FIBRE | Steel, aramid, glass fibre | Friction Material Reinforcement |
| METAL POWDER | Cu,Cu-Zn,Fe,Al,Zn, etc | Increase Friction Co-efficient |
| SOLID LUBRICANT | Graphite,MoS2,mica,etc | Prevent micro-stick to the rotor |
| ABRASIVE | Al2SO3,SiO2,MgO,Fe2O4 etc | Cleaning surface of rotor |
| ORGANIC FILLER | Cashew dust, Rubber, etc | Reduce wear at low temperature |
| NON-ORGANIC FILER | BaSO4, CaCO3, Ca(OH)2 | Reduce wear at high temperature |

Source: SAE technical Paper Series 930806-Development of Brake Friction Materials

The most common fibre in use today is aramid, with some metal fibre – steel or copper, or in some cases glass fibre or ceramic fibres. The proportion of fibre in the mix varies from 5% to over 50%. There are new fibre materials continually being developed and tested, including a product which is described as “bio-soluble” and is exempted from the general classification of “possibly carcinogenic” in Europe. This fibre is available in a range of formulations suited to the complete range of vehicle friction products. The point is that the technology is evolving rapidly and the performance of non-asbestos friction products is improving as well as being tailored to suit the requirements of individual applications.

The resin is the essential binder and phenolic resins remain the most common. The most popular lubricant is graphite and the particle size and purity are important parameters for optimum performance.

Metal powders are used to increase the friction coefficient. Copper and brass particles are commonly used (less hard than the rotor). Aluminium and Zinc powders may also be used. Ceramic powders are used to help keep the rotor clean, but the quantity must be carefully controlled to avoid problems such as excessive wear.

Organic and inorganic fillers such as cashew dust and barium sulphate ($BaSO_{4)}$ are used to enhance low temperature and high temperature characteristics.

A mix might contain the following fibres - carbon (improve high temperature friction coefficient), Aramid (improve strength and wear properties), Copper (improve friction coefficient and high temperature strength), and ceramic fibre (reduce thermal conductivity and improve high temperature strength). Such a mix would show better fade and wear characteristics than a typical asbestos-based mix. It is of interest to note that the wear characteristics show that the non-asbestos product gives lower wear (and hence longer life) over a wide temperature range, with the performance increment increasing significantly with increased temperature. The expected pad life of one non-asbestos product is about 30% greater than the asbestos product.

The friction performance of high quality non-asbestos product is also claimed to be superior to asbestos product, with lower pedal effort to achieve the same deceleration. Noise and judder performance is also claimed to be superior to asbestos product.

These performance characteristics show that it is now possible to produce vehicle friction materials with superior performance characteristics. This is confirmed by the product now available in the marketplace, which takes advantage of more recent developments to offer a high performance level across a range of parameters at a reasonable price level.

The longer life of non-asbestos product carries over into heavy vehicle friction products, where extensive field experience shows the initial cost margin is more than offset by the longer in-service life. It has to be admitted that anecdotal evidence suggests that this experience is not universal. Many factors can enter into this issue, and there is very little controlled experimentation. The data used in the UK regulatory impact statement confirms an expectation of longer life from non-asbestos friction product

The literature and the market situation in Australia both suggest that the most difficult area for non-asbestos friction materials is linings for drum brakes for light vehicles. There are a number of reasons for this, including production problems and the fact that the light vehicles linings market is a declining market as disc brakes become more dominant. Consequently there is a limited incentive to develop product in Australia while asbestos product remains freely available.

However, the vehicle manufacturers have shown that it is possible to develop product and production processes for non-asbestos lining materials and developments in Europe confirm that suitable after-market materials can be developed and marketed.

**Market Issues**

The Australian after-market for vehicle friction materials is still dominated by asbestos product. This is due to a range of factors:

- Market prejudice against non-asbestos product.
- Freely available asbestos product at a very competitive price
- Poor quality non-asbestos product, historically in Australian made product and today in some imported product
- Investment constraints for Australian manufacture of non-asbestos replacement light vehicle linings

- Pricing of non-asbestos product, generally at a significant cost premium over asbestos product

While there is no restriction on the supply of asbestos product, this market situation is unlikely to change. The penetration of non-asbestos product in the heavy vehicle sector can be expected to increase as the superior performance of high quality non-asbestos product becomes better understood across the transport sector.

The introduction by Bendix Mintex of the "Premium" product range, priced competitively with their asbestos range of disc pads, will also help to increase the penetration of non-asbestos in the replacement disc pad market. The other, smaller Australian manufacturers already price their replacement disc pads competitively.

Moves to phase out the use of asbestos product could be expected to lead to Australian production of non-asbestos light vehicle replacement linings and the import of suitable product. The issue would be the time scale allowed. The time scale would need to allow for the run-down of existing stocks as well as the development of appropriate production facilities. There would also be some restructuring in the brake service sector as it is likely that replacement linings would not be supplied in "un-cut" form, but rather as "ready to use" lining sets.

Another market issue is consumer education. The proliferation of suppliers in the market and the range of product offered by individual companies creates a situation where there could be concerns regarding the "mixing" of replacement components on a vehicle, with adverse effects on braking performance. While this is a real issue, the situation already exists in the market, and could not be attributed to the phase-out of asbestos product. This is not to say that there is not a need for consumer and brake service sector education to ensure that safety problems do not arise.

The issue of product quality is already causing concern in the friction product market. There is effectively no regulation of replacement product quality in Australia. Poor quality product, both asbestos and non-asbestos, is imported and is generally priced very competitively. Moves to introduce a product standard seem to have stalled. This contrasts to the situation in Europe where replacement friction product is tightly regulated. One concern in Australia is that such regulation would add to costs and could disadvantage locally produced product in the market. Another concern is that there is no visible safety issue in the field as a result of poor quality replacement friction product. This may well be because the problems are not identified in accident analysis, or because the main problem relates to short life of the replacement components rather that poor brake performance.

The issue of investment constraints is related to both the declining market for drum brake replacement linings for light vehicles and the availability of asbestos based product at very competitive prices. If it was clear that asbestos product would be phased out, manufacturers could plan to meet the demand for non-asbestos product. Importers could also revise their product line to provide non-asbestos replacement linings. Given that satisfactory product for vehicles originally fitted with non-asbestos brake systems is available as OE replacement parts, it is clear that suitable technology exists to produce satisfactory non-asbestos replacement linings. The problem is therefore one of the market and customer perceptions.

The pricing regime for non-asbestos product traditionally is set at a premium to that of asbestos product. There is some evidence to suggest that the pricing regime could be revised today to price non-asbestos product closer to asbestos product. The recent release of the Bendix Mintex "Premium" product line suggests

that current technology allows the production of competitively priced non-asbestos replacement friction components. This has been confirmed in discussion with other manufacturers.

**Summary**

The evidence suggests that technology exists today to produce satisfactory non-asbestos replacement friction components at a competitive price. All new vehicles are marketed with non-asbestos friction components. The after-market offers a range of non-asbestos replacement friction parts, while manufacturers offer replacement OE parts. The recent EU and UK programs to phase out chrysotile asbestos confirm that it is possible to produce satisfactory non-asbestos replacement friction product.

Replacement friction parts are offered in a range of formulations for specific purposes or sub-markets. There are products tailored for normal suburban use, for heavy city driving, for 4WD and for high performance including competition. This reflects the rapid development in the technology of non-asbestos friction products and a better understanding of the braking performance that can be achieved.

Brake system design and friction product development remains a complex area, with trade-off between a range of conflicting objectives such as cost, performance, noise, smell and product life.

There are concerns regarding consistent product quality in the market and there may be a need for some regulatory action. This is a current issue not directly related to the phase out of asbestos-based friction product.

# ATTACHMENT 4

# EUROPEAN REGULATION – EU DIRECTIVE AND UK REGULATION

## EU Directive

The EU directive itself is quite simple, consisting of three short articles:

1. Adapts Directive 76/769/EEC to technical progress as set out in the annex

2. Requires Member States to "bring into force laws, regulations and Administrative provisions necessary to comply" with the directive by 1 January 05 at the latest

3. Sets out that the directive shall enter into force 20 days after publication in the official journal.

The substance of the directive is set out in the annex which amends Directive 76/769/EEC to prohibit the marketing and use of chrysotile asbestos fibre and products containing the fibre (added intentionally). The only exemption set out is diaphragms for existing electrolysis installations until they reach the end of their service life or a satisfactory non-asbestos substitute is developed. This is to be reviewed before 1 January 08. The annex allows continued use of products already installed or in service, but allows Member States to move earlier for reasons of public health.

The "Declarations by the Commission and Member States" sets out the following:

1. Provides for further research on chrysotile asbestos and substitute fibres regarding health concerns, and provides for a review to be undertaken before 1 January 03

2. Provides for continuing review of the exemption for electrolysis diaphragms and any requests for further exemptions. The industry is requested to demonstrate that "all possible efforts are being made to develop substitutes and that the risk if exposure to chrysotile asbestos in the manufacture, use and disposal of diaphragms is kept as low as possible"

3. Notes that it is not the intention to require any type of asbestos to be removed, and that the uncontrolled removal of asbestos is strongly discouraged.

The explanatory note sets out the history of moves to ban the use of asbestos, noting that the earliest move to ban asbestos was in Denmark in 1972. The note also sets out the evolution of European legislation on asbestos and recent developments in national legislation on asbestos. At the time (April 1999, there were 9 member states with bans and 3 more which supported bans (UK, Ireland and Luxembourg). UK has since introduced bans.

The note then canvasses the scientific issues, including the health risks of substitute fibres. It notes that the recommendation from the scientific committee is "*both for the induction of lung and pleural cancer and lung fibrosis ...and for other effects, it is unlikely that the either cellulose, PVA or P-aramid fibres pose an equal or greater risk than chrysotile asbestos. With regard to carciniogenesis and induction of lung fibrosis, the risk is likely to be lower*". The committee recommended further research on both the effects of the substitute fibres and on the development of new, less respirable fibres. (It is understood that research on the development of new fibre materials is continuing and new fibres are emerging which meet the criteria for less health risk)

The note then comments on the economic issues for some member states, particularly Spain, Portugal and Greece. It concludes that a 5-year transition period would be appropriate.

The note then comments on the issue of worker exposure to asbestos.

The issue of criteria for exemptions is canvassed in some detail, recognising that some exceptions would be inevitable. The criteria given are:

1. Is it technically possible to substitute?

2. Is the substitute less hazardous to human health, safety and the environment?

3. Does the substitute perform to the same standard? (secondary importance)

4. It is noted that economic considerations are important but not decisive.

It is of interest to note the comment:

> "According to World Trade Organisation rules, it is simply not possible to have economic derogations from a measure introduced for the protection of health".

The document then goes on to state that experience in Germany and France showed that "it is possible to for almost all uses of chrysotile asbestos to be replaced by substitutes, given sufficient time."

## The UK Legislation

The UK has moved to introduce legislation to ban the use of chrysotile asbestos through regulations introduced under the "Health and Safety at Work 1974 Act" and separate regulations under the "Consumer Protection Act, 1987". ". These regulations were introduced in the context of existing regulations requiring that asbestos product only be used where suitable non-asbestos product is not available.

The situation is summarised in Press release E146:99 of 2 August 99. The Control of Asbestos at Work (CAWR) Regulations 1987 require "asbestos to be substituted where this is practical and where the substitute is safer than asbestos". This is further clarified as follows:

Regulation 8(1A) of CAWR requires substitution of asbestos where this is practicable, and where the substitute does not create a risk to health or is safer than asbestos.

- The use of the term "practicable" means, in law, that cost is not a consideration. If it is technically possible to use a safer material than asbestos, this must be done.

- The UK's Department of Health Committee on Carcinogenicity has concluded that three commonly used asbestos substitute fibres are safer than chrysotile asbestos.

- Friction material suppliers now have a wide range of non-asbestos brake products available, which they advise would ensure a safe stopping performance when properly used.

- The requirements of CAWR apply to vehicles and trailers of all types and all ages and to any use of asbestos on those vehicles, including clutches and gaskets as well as brakes.

- CAWR applies to manufacturers and installers. It does not apply directly to importers or suppliers, but other provisions of the Health and Safety at Work Act could be used to prevent suppliers selling a product the customer could not legally use."

The official position on the use of asbestos brake components is summarised succinctly in the following:

> "We have an al allegation from a reliable source that some fleet operators may have fitted asbestos brakes back on to vehicles originally supplied with asbestos-free brakes, simply because they are cheaper. This in our view would be a blatant breach of the Control of Asbestos at Work Regulations, and legal proceedings would be considered if this were found."

In the Australian context, it is important to note that the UK regulations to ban the use of asbestos were introduced in 1999 in a climate where clear signals had been given on future directions as far back as 1987. Industry had ample time to develop alternative product and prepare the market.

The Asbestos (Prohibitions) (Amendment) (No2) Regulations 1999 provide that the importation of chrysotile asbestos or any product containing chrysotile asbestos is prohibited. The supply or use of chrysotile asbestos or any product containing chrysotile asbestos is also prohibited, unless it was in use before 24 November 99. An exemption process is provided for Defence purposes, subject to timing and conditions.

Exemptions are provided for in “The Schedule” – Derogations from the Prohibition on the Importation, Supply and Use of Chrysotile Asbestos. The exemptions include:

- compressed fibre gaskets for use with chlorine (until 2003)

- compressed fibre gaskets in general (until 2001)

- sheet with a density greater than 1900 kg/mcubic metre and for use above 500°C (until 1 January 03)

- any component of a helicopter or aeroplane which is necessary for its safe operation. (until 1 January 04)

- any product used in vanes for rotary pumps or compressors, bearings or housings and split face seals for electricity generation plants

  (until 1 January 04)

- steam boiler door joint seals (until 1 January 04)
- personal protective clothing for use above 500°C (until 1 January 05)
- brake linings
- diaphragms for use in electrolysis
- receptacles for the storage of acetylene gas, in use before 24 November 99

Replacement Brake Linings are addressed specifically in "The Road Vehicles Brake Linings Safety Regulations 1999". Brake linings are defined to include both drum brake and disc brake friction materials. The regulations provide for a ban on:

- the supply (or offer to supply) for fitting to a vehicle
- exposure or possessing for fitting to a vehicle
- fitting to a vehicles

of brake linings containing asbestos.

An exemption is provided for **pre 1973 vehicles**, with the requirement that replacement disc pads and linings be clearly marked "illegal to fit to **post 1972 vehicles".**

The regulations prohibit the supply of replacement linings for vehicles under 3.5 tonnes which do not meet the requirements of the "Brake Service Directive", effectively requiring that the replacement linings be capable of meeting the performance standards for new vehicles and be so labelled. This is subject to an exemption for vehicles first used before 1 April 98 provided the linings are capable of meeting the performance standards.

The regulations also require that replacement linings for vehicles over 3.5 tonnes must be capable of meeting the relevant performance requirements. There is also a requirement that proceedings be brought within 12 months.

A Regulatory Impact Statement (RIS) accompanies the regulations. The RIS notes that the road safety benefits of the measure are not compelling, and that the measures are driven by the public and worker safety issues.

The exemption for pre 1973 vehicles is not justified on technical grounds (suitable replacement non-asbestos materials could not be produced). It is justified on the grounds that the small number of such vehicles might mean that suitable quantities of non-asbestos replacement materials could not be guaranteed ie the industry would not invest to supply non-asbestos materials for such a small market. It is also noted that such vehicles are generally enthusiasts vehicles unlikely to be used extensively or subject to heavy wear.

The RIS addresses the costs of the measure, noting the higher costs of non-asbestos materials (25% assumed) and the longer life (20% assumed). It is relevant to note that field experience in Australia suggests that heavy vehicles using reputable non-asbestos replacement linings are finding an improvement in lining life well in excess of 20% and even up to 100% in some instances.

# ATTACHMENT 5

# ANALYSIS OF MARKET COVERAGE

This attachment is not presented as a comprehensive analysis of the marketplace. It is intended rather to give an indication of the market nature and the coverage of some significant players in the market.

Bendix Mintex is the largest supplier of vehicle brake friction material components in Australia, understood to have over 50% of the market. Bendix Mintex, offers four non-asbestos disc pad lines and one asbestos line. Bendix Mintex also offers asbestos based linings for light vehicles, and asbestos and non-asbestos brake blocks and linings for heavy vehicles. The Bendix Mintex catalogue also includes replacement friction components for industrial and rail equipment.

There are smaller manufacturers of after-market replacement disc pads. Typically, the smaller manufacturer's product line is focussed on popular vehicle models, and the range of product lines offered is two or three. This is a logical strategy for a small competitor, reducing inventory holdings and product development costs.

There are a number of importers of brake friction materials, ranging from those specialising in non-asbestos components to those specialising in asbestos components. Some large retail spare parts chains also import asbestos product and non-asbestos product directly. There are estimated to be some 50 brand name disc pads offered in the Australian market. It has to be recognised that some product lines are proprietary packaging of a manufacturer's product under a different brand name.

## Bendix Mintex Product Line –

### Disc Pads

The Bendix Mintex product line for disc pads offers five different pad materials:

- "Metal King Plus", the first non-asbestos product line
- "Ultimate" and "Performax", the high performance lines
- "4WD", formulated specifically for use in 4WD vehicles
- The "Euro-Pack" line, formulated to replicate the braking performance and feel of European vehicles
- The "Taxi-Pack line, formulated specifically for taxi service
- The "Standard" asbestos based line

The "Metal King Plus" product is a semi-metallic compound recommended for constant driving in heavy traffic conditions – couriers and sales representatives - and for towing. It is a heavy duty disc pad with good excellent high temperature wear and fade characteristics. This product line has been on the market for a considerable time and is offered for a wide range of vehicles.

The “Ultimate” and “Performax” lines are the high performance lines, with excellent fade characteristics, suitable for sports, prestige and performance vehicles.

The 4WD line is designed for 4WD vehicles and offers extended pad life and good fade characteristics. It is recommended for city, country and outback roads.

The Taxi-Pack” line is formulated to suit the conditions of taxi operations.

The “Euro-Pack” line is formulated to suit European vehicles and suited for general purpose suburban and touring use.

The “Standard” line is a general purpose, asbestos based product line suited to passenger vehicles and offered for light commercial vehicles.

Bendix Mintex offers replacement disc pads for a very wide range of vehicle models. For light vehicles, the disc pad product line covers around 1200 model ranges. The “Standard” asbestos disc pad line covers around 1180 of these, while the “Metal King Plus” line covers around 1192 model lines. The models where the Standard line is not offered are relatively new, low volume lines.

The other product lines are offered for a smaller range of vehicle models as would be expected. The newest product line, the “Premium” is a general purpose line specifically designed to compete directly with the asbestos based product, the Standard. It is priced competitively and the range (currently around 220) will be extended over time. The product is offered predominantly in the high volume lines at this time.

It is worth noting that the Bendix Mintex product line is based on some 400 different disc pad patterns, and some 50% of these have more than one type eg left and right hand configurations or inner and outer pads. This shows some commonality across the models covered as would be expected. However, it also shows the wide variety of brake systems in use on the vehicle fleet.

The key point is that the non-asbestos disc pad product range on offer covers the majority of vehicle models in the Australian market. For many models a range of non-asbestos products is offered. In particular, the new “Premium” product line is designed to be directly competitive with the asbestos based “Standard” product line.

**Brake Linings**

Bendix Mintex does not currently offer non-asbestos replacement brake linings in its locally manufactured product. It is understood that there are plans to offer non-asbestos product in the future. Bendix Mintex has access to international technology to produce replacement non-asbestos linings.

Brake linings for light vehicles are generally sold as pre-cut sets, ready for bonding to brake shoes. There is also some supply of bulk relining material. Riveted linings are uncommon today for light vehicles. For popular models, brake bonders offer exchange services, while for other models, the vehicle brake shoes are sent to the bonders to be fitted with new linings.

The fact that Bendix Mintex does not offer non-asbestos replacement linings probably goes some way to explaining the use of asbestos linings on vehicles originally supplied with non-asbestos linings. Other suppliers in the market do offer a range of non-asbestos linings, and the vehicle manufacturers do offer non-asbestos replacement linings for vehicles supplied with non-asbestos linings.

Asbestos based product is generally cheaper, and has a good market image for performance and life.

### Heavy Vehicle Brake Blocks

Bendix Mintex offers both asbestos and non-asbestos replacement brake blocks for a wide range of vehicles and trailers, as well as a range of industrial equipment – fork lifts, tractors. The parts are generally supplied ready to fit to the brake shoes, riveted or bonded. Some bonders are supplied with product suited only for bonding. Bendix Mintex has for some time been concerned regarding the use of the right rivets for heavy vehicles, and recommends steel or brass rivets – not aluminium. Some bolted linings are also supplied where the original specification was for bolted linings.

The heavy vehicle product line comprises some 370 product codes, again showing the complexity of the replacement parts sector. There is also the added complication of oversize linings to deal with reground and hence oversize drake drums. It is still common to surface grind heavy vehicle relined brake shoes to fit the drums, which may not be reground to a standard oversize. However, discussions with brake service operators suggest that regrinding is less common today.

The “Ultravar” non-asbestos product is offered in four friction classifications. The “Standard” asbestos product is offered in six classifications. The friction classifications reflect the hot and cold coefficient of friction, ranging from 0.15 to 0.55.

It is important to note that both non-asbestos and asbestos product are offered for all models covered in the Bendix Mintex heavy vehicle product range.

### Other Industrial Products

Bendix Mintex offers a range of rail and industrial products, including disc pads and brake linings. Bendix Mintex also offers imported non-asbestos woven roll friction material for industrial uses.

## Other Australian Manufacturers

There are several smaller manufacturers of non-asbestos disc pad replacement product in Australia. This section briefly describes QFM (Queensland Friction Manufacturers), a Queensland based manufacturer.

QFM is a small manufacturer of replacement light vehicle non-asbestos disc pads, estimated to hold around 10% of the market. The QFM product line is described as organo-metallic, and is a low metal composition. The company offers a product line of some 260 replacement disc pad types. QFM offers several product formulations for the market, covering normal use, heavy duty (4WD) and taxi operations. QFM also offers high performance pads for competition for a limited range of vehicles and a range of pads for specialised operations.

QFM has an active research and development program and carries out regular product testing, both in vehicle and in laboratory. QFM offered access to test data on their product and competitive product, based on road tests on a particular vehicle. The data demonstrated that it is possible to develop non-asbestos replacement product which will match or better the performance of asbestos product.

QFM is able to offer specialised services for rare vehicles and has prepared small numbers of replacement pads for such vehicles. QFM has also prepared replacement pads for rare vehicles by moulding new friction product onto existing used backing plates.

The QFM product line covers a relatively wide vehicle range by focussing on the popular vehicles. Within the popular vehicle ranges, the product offering is not as comprehensive as the Bendix Mintex range. The QFM product line also covers some of the rarer vehicles. The product line does not cover some of the newer vehicle manufacturers in the Australian market.

QFM strongly supports the phasing out of chrysotile asbestos for replacement product. This is based on health grounds, but would provide a larger potential market for QFM. QFM is confident that their product will meet the performance requirements of the ADRs and can be used safely in vehicles originally fitted with asbestos product.

Discussions with National Disc Pads (NDP) of Melbourne reveal a similar picture to QFM, although their product range is larger, with a smaller market share estimate. NDP is also confident that their product will meet the performance requirements of the ADRs and can be used successfully on vehicles originally fitted with asbestos pads. NDP also hold test evidence to support their performance claims and note that their product is used exclusively on the Melbourne taxi fleet.

NDP product is priced competitively with Bendix Mintex asbestos disc pads.

## Importers

There are a number of importers in the broader friction products area, ranging from brake bonders who import asbestos product for brake re-lining to importers who bring in a wide range of friction product for road vehicles and industrial uses. While some importers only deal in non-asbestos product, others find customer demand for asbestos product leads them to bring in both asbestos product and non-asbestos product.

Taro Distributors is one of the more significant importers of non-asbestos for road vehicle brakes, mainly heavy vehicle brakes. Taro offers a high quality non-asbestos heavy vehicle brake line which is certified to the European requirements. The main market is large fleet operators, where a combination of economics and industrial issues encourages the use of non-asbestos replacement product.

Taro also imports asbestos product to meet customer demand. The product line for drilled brake linings comprises 370 items, 65 being non-asbestos. Taro also offers 90 undrilled brake segment items and 72 clutch facing items, all asbestos product.

Taro also imports moulded and woven roll for industrial use, with both asbestos product and non-asbestos offered for most sizes.

Taro noted the product quality issues for importers and commented that it was necessary to be very careful to ensure consistent product quality issues. Taro also noted that there was a wide range of sources available for non-asbestos product.

It is worth noting that a number of industrial friction product importers now specialise in non-asbestos product. This indicates some expectation of a move to phase out chrysotile asbestos and confidence on the performance of non-asbestos product.

## Comment

The interesting point to notice is that Bendix Mintex appears to offer non-asbestos product for virtually all models covered in the disc pad range, and for all models covered in the heavy vehicle product range.

The only major sector not currently covered in the non-asbestos product range is replacement linings for drum brakes for light vehicles. This may reflect the market reality that the drum brake linings sector is a vanishing market as disc brakes dominate the market to an ever greater extent, and perhaps production issues in the main Bendix Mintex plant. However, there is clear evidence that non-asbestos replacement product for drum brake linings can be produced, both from new vehicle manufacturers and the situation in overseas markets.

There is also competition in the market for replacement product from local disc pad manufacturers and importers. In the current market, which does not restrict the use of asbestos product, there is strong competition from imported asbestos product, particularly in the disc pad and light vehicle linings sector.

Importers offer a range of product in the market. There are some importers specialising in asbestos product, generally for further processing such as relining drum brakes. There are also importers who offer customers a choice of asbestos or non-asbestos product. There are some importers who only offer non-asbestos product.

There is a common view that non-asbestos product can be produced which will perform as well as asbestos product. On the other hand, those who specialise in asbestos product tend to be strongly of the view that there are still performance issues with non-asbestos product. There is a widespread recognition that asbestos product is likely to be phased out, particularly in the light of European moves to ban the use of chrysotile asbestos.

# ATTACHMENT 6

# OTHER INDUSTRIAL USES OF CHRYSOTILE ASBESTOS

## Introduction

The following report forms part of the Technical Assessment of the Impact of a Phase-Out of Uses of Chrysotile Asbestos in Australia.

This part of the study focussed on industrial applications of chrysotile asbestos, not including friction materials. This is a very broad and diverse category and this report is not an exhaustive study of all applications.

A survey of current literature was conducted to obtain general information about the properties of asbestos and its substitutes, and obtain information about applications and limitation of asbestos substitutes. Industries identified during the literature survey were approached and given the opportunity to provide information on current uses of chrysotile asbestos.

## Properties of chrysotile asbestos

The properties of chrysotile asbestos were examined to assist in assessing the requirements and merits of proposed replacements. The properties of chrysotile asbestos are briefly discussed below.

### Thermal Insulation

Asbestos is a very poor conductor of heat. For this reason in the past many applications of asbestos were found in thermal insulation and lagging. While there may be many in situ instances of asbestos used as insulation, information obtained as a result of this study indicates that no new installations are using asbestos.

### Electrical Insulation

Asbestos is also a very poor conductor of electricity. Asbestos electrical insulation does not appear to be used in new installations.

### Heat Resistance

Resistance to melting, burning, softening and degradation as a result of heat has proved to be one of the most useful and important characteristics of asbestos. This property alone has made asbestos a difficult material to replace. The potential combination of this property with some or all of the other useful characteristics of this material mean that it is not an easy material to replace in many applications. Beercheck 1982, reports the maximum operating temperature of asbestos packings as 650 C (1200 F), and Royse 1988, reports nearly faultless performance of calendered asbestos gaskets for high pressure steam flanges up to 550 C (1020 F).

### Compressibility

The ability of asbestos to be compressed without rupturing or extruding, makes it very useful for gaskets, packings and seals. A sealing material must squash into

the imperfections on surfaces of the sealing faces to prevent fluid or gas leakage. Hodgson 1989, suggests that asbestos gaskets can be used on cast flange surfaces.

**Resilience and Creep Resistance**

To perform as a seal a material must compress and conform to the profile of the sealing faces. The material must retain its elastisticity or resilience to maintain a constant sealing pressure. The creep resistance and resilience of asbestos is one of its important characteristics.

**Relatively High Tensile Strength**

Asbestos has proven useful for gland packings because it is able to resist tearing under the forces generated by the rotating shaft and friction.

**Relatively High Wear Resistance**

Asbestos is relatively hard and resistant to wear. This is useful for gland packings where a rotating shaft is continually running on the sealing material.

**Resistant to Chemical Attack**

Resistance to many chemicals makes asbestos very useful in many applications in chemical plants. In combination with some of the other properties mean that asbestos finds uses as seals, gaskets, filters, membranes and rubbing pads in chemical processing equipment.

## Applications of chrysotile asbestos

The focus of this current study is to consider the major current applications of chrysotile asbestos, and examine what alternatives are available.

Leigh 1999, indicates economic alternatives to asbestos exist for all applications. This blanket statement needs further consideration. The following paragraphs outline the current applications that have been investigated as a part of this study.

**Dry Packings**

Dry Packings for seals which are generally not gas tight, but provide a better sealing system than metal to metal where the surfaces are rough (such as castings). Applications of dry packings may include furnace and kiln door seals and exhaust manifolds. Dry packings may experience high temperatures, impacts and vibrations, and are required to be provide some compressibility for impact deadening and sealing.

Asbestos itself was a substitute for natural fibres such as cotton, flax, jute, and cellulose. In applications were the temperature is not too high these materials may be suitable. Glass fibres have also been used for higher temperature applications. The glass fibres tend to be brittle and not suitable where severe impact or vibration exists. In many instances millboard may be used as dry packing. Issues related to replacements for millboard are discussed below.

Information gather during this study indicates that technically feasible replacements for asbestos dry packings are available for most applications.

### Compression Packings

A compression packing is a woven or braided cord wound into a housing around a shaft where it exits a gearbox, pump or similar equipment. This type of packing forms a seal against fluid existing or entering through the gland. Sometimes a slight clearance between shaft and packing is use to ensure a flow of lubricate is maintained.

The conditions experienced by the packing material vary widely depending on the application. The packing will almost always experience wear, as the shaft rotates. Often chemicals such as oil, water, seawater and others may be present, so the resistance to chemical attack may be important. Elevated temperatures may occur as a result of friction with the shaft and/or high temperature fluids.

Product literature on substitute materials claim that materials with a working temperature ranging from –250 C to 650 C are available (no one material is expected to achieve this range). The types of yarns used in these replacement materials include graphite, carbon, PTFE, Polyimide, Arimid, Nickel, Chrome, Acrylic, Cotton, Flax, Ramie and Phenolic. Other chemicals are added to enhance the properties of these materials to increase lubrication and chemical resistance.

The maximum temperature for asbestos packings was noted earlier as being 650 C. Chemical resistance, and wear rates would have to be consider for individual applications, but it does appear that there are technically feasible substitutes for asbestos compression packings.

### Proofed Asbestos Products

Proofed asbestos products consist of asbestos fibre proofed (or coated) with a soft material such as rubber or elastomer. Proofed asbestos products are used for soft gasket seals. These applications typically have rough (possibly as cast) sealing surfaces. Applications would be typically low temperature (less than 100 C) and low pressure (<300 kPa). Gas sealing and chemical resistance may be required.

The asbestos fibre forms a strengthen function for the elastomer, helping to reduce the extrusion of the soft material. The wettability of the asbestos fibres is the primary property of asbestos that is required. Various chemical additives have been developed to improve the wettability of other fibres such as cellulose and glass.

Kaufmann 1986, indicates that reinforced cellulose duplicates all the performance parameters of asbestos except high temperatures. So for applications with maximum temperatures below 175 C (350 F) cellulose fibres can adequately replace asbestos. Some redesign of the joint may be required to achieve the same sealing parameters.

### Compressed Asbestos Fibre

Compressed asbestos fibre or CAF materials are the most common industrial static sealing products. CAF is produced by blending asbestos fibres with rubber or synthetic elastomer, and rolling it into paper like sheets. The asbestos fibre constitutes approximately 70% of the volume of the composite.

CAF is used for static sealing applications in the form of gaskets. Recent product literature is suggesting CAF can be used for temperatures up to 550 C (1020 F), sealing internal pressures up to 14700 kPa. In order to form an effective seal the material must be compressible and maintain it elastistity (creep resistance) to fill

the imperfections in the sealed surface. Tensile strength of the material is also required to avoid being extruded out under clamping force and internal pressure.

Automotive and industrial internal combustion engines commonly use CAF as head gaskets and exhaust gaskets. Head gaskets require sealing of high temperature combustion gases, and resistance to and sealing of high temperature oil. Exhaust gaskets required sealing of high temperature exhaust gases.

CAF is also commonly used in pipes flange seals in chemical plants, oil refineries, and power stations. In these applications chemical resistance and even electrical insulation may be also important.

NOHSC 1999 has indicated that all manufacturers of automobiles in Australia provide non-asbestos head gaskets as original equipment on all current models (the one exception noted in NOHSC 1999 is now no longer a current model). This leads us to the conclusion that it is technically feasible to use non-asbestos head gaskets in light vehicles. A number of companies in Australia manufacture head gaskets from CAF sheet. These companies are supplying the after-market replacement parts, where cost is the primary driving force.

Richard Klinger Pty continues to manufacture CAF from raw chrysotile in Australia. Richard Klinger Pty has indicated that they do not offer asbestos based products for sale to general customers, but continue its manufacture to service long term contract commitments. For these contracts the use of asbestos is being phased out over the next 6 to 12 months. This company offers a computer program to assist in the design of sealing joints, which includes a section on conversion from asbestos to non-asbestos materials. A copy of this program was not available for evaluation at the time of writing this report.

Beercheck 1982 indicates substitutes are available which match each of the properties of asbestos but not all in the same material. Recent product literature indicates the temperature and internal pressure limits of asbestos gaskets can be met and in some cases exceeded by a substitute material. US patent no 4 786 670 presents an example of a non-asbestos high temperature sheet material suitable for gaskets. The material is claimed to survive in excess of 550 C (1200 F). There are numerous other patents which outline compressed non-asbestos fibre sheets.

The chemical resistance of compressed non-asbestos fibre sheets is not clearly demonstrated in the literature, although at least one Australian manufacturer is offering chemical resistant compressed non-asbestos fibre sheets. Therefore, we believe it is technical feasible to replace CAF with non-asbestos material with appropriate design modification, and specific application testing.

**Millboard**

Millboard is a solid composite material formed by moulding a thermosetting base containing asbestos fibres. The millboard can be cut, punched, milled, and drilled. Millboard is used as rollers for transport of hot materials (steel and glass), formers for wire wound electrical resistors and insulation lining for ovens and moulds (to minimise heat loss), plugs and stoppers for molten metal containers.

The heat resistance of asbestos is an important property for millboard, as is thermal insulation and mechanical strength. For the handling of hot glass products the temperature of the component from the oven is expected to be in the range of 300 to 700 C.

US patent no. 5,630,858, dated 20 May 97, claims to have developed a temperature resistant material from fibre re-enforced glass and fibre re-enforced ceramic which will safely handle objects with temperatures in excess of 700 C.

An overseas company called Tenmat, offers non-asbestos millboard, material with the trade name FireFly Millboard. The material is claimed to be suitable for temperatures up to 1800 C, and chemical resistance, stability in oil, water and steam is also claimed.

The information leads us to the conclusion that it is technically feasible to replace current applications of asbestos-based millboard with non-asbestos material.

**Dry Rubbing Bearings**

Dry rubbing bearings are plain bearings where lubrication is not possible, sparse or in situ (eg seawater). Asbestos dry rubbing bearing are manufactured by impregnating asbestos cloth or fibres with thermosetting phenolic resins. Dry rubbing bearings can sometimes be pre-impregnated with lubricants, and may also be known as self-lubricating bearings.

Common applications of dry rubbing bearings include low speed high-pressure shafts and glands, such as large power station feed water valves, marine rudder, steering, and stern tubes. Characteristics required for dry rubbing bearings is high compressive strength and resistance to wear. In some applications resistance to heat (generated through friction) and stability in fluids (such as seawater and oil) are also required.

Prior to the wide spread use of asbestos dry rubbing bearings were typically made from hardwood (lignum vitae) staves with a gunmetal bushing. More recently bronze, white metal, non-asbestos reinforced thermosets have also been used. Polyester bonded textile laminates with molybdenum sulphide or graphite, cellulose fabric based phenolic laminates with PTFE or graphite, polyamides, PTFE filled with glass fibres, mica or ceramic fibres, polyamide, woven and rein-bonded PTFE fibres, graphite bound high temp resins, graphite impregnated metals and PTFE-impregnated metals are other examples of plain bearings. Nylons and acetals can be used for bearings for less demanding applications

HyComp Incorporated, in the United States offers a high temperature non-asbestos fibre reinforced dry bearing material. The manufacture claims temperature resistance to 290 C (550 F), low coefficient of friction, zero creep, high impact and vibration resistance, and low wear. More detail information was not available. Tenmat claim their self-lubricating bearing material is targeted at replacing asbestos based material. Tenmat's bearing material is available in grades suitable up to 350 C (660 F).

The range of alternatives for asbestos dry rubbing bearings is very broad, and hence we believe asbestos materials can be replaced in most, if not all, applications of dry rubbing bearings.

**Reinforced Plastic Composites**

Reinforced plastic composite materials are made by mixing a fibrous material with a thermosetting or thermoplastic base material, and forming the finished shape in an injection moulding process. One of the earliest fibres to be used was asbestos.

These materials are very similar to dry rubbing bearings, except the shape formed is not necessarily cylindrical. Applications may include machine parts, such as

guides, rollers, and mountings. As this is such a broad category of applications a wide variety of service conditions may exist. Some typical service conditions may include high temperature, sliding friction (wear), chemical attack, and compressive or tensile stresses.

The technical issues related to replacement of asbestos based plastic composites are similar to those discussed with dry rubbing bearings, and hence the conclusion is that most, if not all, asbestos reinforced plastics can be replaced with non-asbestos material.

**Diaphragms and Electrolytic Cells**

Asbestos fibres are used in chemical processing plants as membranes or diaphragms used in the processing and production of chemicals. One specific application is as a diaphragm in the electrolysis of sodium chloride solutions to produce caustic soda and chlorine. These diaphragms were fabricated by depositing asbestos fibres in an aqueous mash onto a cathode that is permeable to the electrolytes.

The asbestos provides low electrical conductivity, thin coating, large surface area and compatibility with chemicals involved.

US patent no. 5,626,905, describes an invention which is claimed to satisfactorily perform the function of asbestos in the electrolysis of sodium chloride to form caustic soda and chlorine. A number of other patents also describe inventions that satisfactorily replace asbestos in the electrolysis of sodium chloride solutions to form caustic soda and chlorine.

Orica Pty Ltd (the Australian Branch of ICI) has a chlor-alkali plant in New South Wales producing chlorine and caustic soda by the electrolysis of salt water. They have indicated that they no longer use asbestos for this process.

No other examples of asbestos use in chemical processing were found. For the electrolysis of sodium chloride there does appear to be technically feasibly alternatives to asbestos.

European Union documentation suggested diaphragms for electrolysis may require an exclusion from any proposed ban. The literature suggested that there are technically feasible replacement materials, and this was confirmed by one company performing this operation. Given the caution taken by the European Union, this issue should be considered carefully and proposals for action negotiated specifically with the relevant organisations.

**Filters**

Asbestos cloth has been used for the filtering of liquids. One specific example found related to the production of beer, known as kieselguhr filtration. The fibrous nature of asbestos allows liquid to pass through and solid particles (up to a limited size) are trapped. The tensile strength and resilience of asbestos meant that it could be used as the body or structure of the filter as well. This eliminated the requirement to provide support for the filter medium.

US patent no. 4,149,975, dated in 1979 describes a non-asbestos filter specifically for the production of beer as mention above. Other patents, such as USP 4,676,904 (1987), describes another non-asbestos filter with improved performance.

From the applications that could be found technically feasible replacements exist for asbestos-based filters. Other filtering application may exist which require the specialise properties of asbestos, such as chemical resistance.

**Asbestos Binders for Adhesives**

Vivacity Engineering Pty Ltd specialises in the production of adhesives for panels in high rise buildings. The panels provide thermal and acoustic insulation for the buildings. They were traditionally fixed in place with metal brackets. The metal fixtures were found to cause cracking of the panels due to thermal expansion.

The product supplied by Vivacity contains approximately 1% of chrysotile asbestos by mass. The asbestos acts as a binder to reduce creep. Vivacity has indicated they have no suitable replacement for asbestos at this time. They are actively pursuing alternatives, and expected to achieve replacement within three years.

Most of Vivacity's market is export, with only a very small amount of product used in Australia.

## Applications not covered by this report

The following list is included to assist the reader to ensure all applications are covered.

Asbestos reinforced concrete

Chaulking compounds

Asphalt products

Vinyl asbestos floor coverings

Pipe and electrical coverings

Conveyer belts.

Sprayed coatings

Adhesives, sealants and mastics

Insulating boards

Roofing felts

Textured paints

Fire resistant clothing

Automotive brakes and clutches

## Industries Consulted

The follow paragraphs summarise the results of consultation with industries believed to be currently using asbestos. To perform this consultation process, relevant companies were contacted by telephone, and were sent surveys to formalise the results. Very few written surveys were returned.

**Automotive**

The automotive industry has used asbestos materials for head gaskets, exhaust gaskets, brake linings, and clutch linings. Issues related to clutch and brakes have been addressed by other sections of the report.

- Original Equipment Manufacturers

NOHSC 1999, indicated that all but one Australian car manufacture fitted non-asbestos gaskets on all current models. The one manufacture identified as fitting asbestos to current models has indicated that those models are now no longer current.

- After-market Replacement Parts

Manufacturers, and importers of gasket materials for the after-market industry are continuing to supply asbestos products. The companies who provided information have indicated the sole reason for the continued supply of asbestos gaskets is cost.

**Petro-chemical**

Petro-chemical industry includes extraction of crude oil, transportation of crude, processing of crude oils, production of fuels and lubricants, and distributions of fuels and lubricants. Surveys were sent to oil companies, oil refineries, and consultants in the petrochemical industry. Two oil refineries completed and returned the survey and a number of companies who supply gaskets to the oil refineries also responded.

Neither refinery indicated that there was any application for which substitutes for asbestos were not available. They did both indicate that there were some perceptions that the non-asbestos product was not as good and may, in some cases, be dangerous. For example possibility of bursting gaskets causing an explosion hazard. One of the refineries indicated the asbestos substitute contained ceramic fibres with possible carcinogenic effects.

One refinery also pointed out the number of substitute materials may open the risk of the incorrect gasket being fitted, leading to the possible hazards associated with a hydrocarbon leak.

Richard Klinger Pty, supplies gasket materials to the petrochemical industry. They are manufacturing CAF for existing long term clients, but are encouraging these clients to switch to non-asbestos product within the next six to twelve months.

ACL specialised gaskets, also supply gaskets materials to the petrochemical industry. They have indicated they know of no applications where asbestos cannot be replaced. The cost of the replacement materials is the primary restriction to replacement. They also noted that some time to assess and choose a specific material for each application would be required.

The information obtained during this study indicated that it is technically feasible to replace asbestos material in the petrochemical industry. As there are a large number of alternatives required to fulfil all the functions of asbestos based material, some time will be required to choose the correct material for each application. The safety implications associated with this industry require that careful consideration and planning be applied to any replacement of existing equipment. Therefore any

proposed ban of asbestos products would require a reasonable period of time for the necessary testing and planning.

**Chemical**

Asbestos materials are used as membranes for processes such as electrolysis of sodium chloride, and as filters for bulk liquids.

Feedback from Orica (ICI) indicated that their production of chlorine from sodium chloride electrolysis no longer requires the use of asbestos. No other applications of asbestos where found in the chemical industry. Technically feasible alternatives are available for all applications of asbestos in the chemical industry found during this study. The possibility of a chemical plants requiring asbestos products for a propriety process suggest that an exemption on application scheme may be appropriate.

**Aircraft**

Asbestos is known to be used in high performance aircraft engines such as gas turbines. Gas turbines typically run very hot and are exposed to aggressive high temperature combustion and exhaust gases. The mechanical requirements of forming sealed joints, insulating high temperature engine parts and tolerating vibration and impact, have meant that asbestos has been widely used.

Tenmat Pty, claim their material FEROFORM has been accepted by Lucas Aerospace, Rolls Royce, and British Aerospace for gaskets, thermal barriers, washers, spacers and pads. FEROFORM is a non-asbestos material.

The local office of Rolls Royce Gas Turbines indicated that asbestos was no longer used in their engines. No other representatives from the aircraft industry responded to our requests for information. Most of the high performance aircraft in Australia are manufactured overseas. Similarly replacement parts come from overseas.

Due to safety implications it may be necessary to allow the high performance aircraft industry to continue to import and use components containing asbestos for a reasonable period of time.

## Asbestos replacement methodology

The report outlines some general cases of materials that can be used in place of asbestos. It does not in any way form a comprehensive replacement guide. Every user of asbestos products must carefully examine the physical, chemical, electrical and thermal environment in which the material is used.

Arnold 1988, outlines a guide and case study of asbestos replacement in aircraft engines. The methodology could equally be applied any use of asbestos material. The five-step procedure outlined by Arnold 1988 is as follows:

1. Identify asbestos-containing materials.

2. Collect data for these parts – determine performance parameters, and environment.

3. Recommend replacement materials – materials supplier's information may help.

4. Perform qualification testing – in house or application specific.

5. Entering qualified materials into specifications – update drawings and specifications.

The paper presented by Royse 1988 presents a case study of qualification testing.

**Standards**

For gaskets, at least, detailed performance standards and testing methods are available for evaluation the characteristics of the substitute material in comparison with the asbestos equivalent. These standards are listed in the bibliography.

**Health aspects**

Detailed consideration of health problems caused by asbestos are not part of the scope of this study. Some of the health problems associated with asbestos include lung cancer, asbestosis, and mesotheliomas. Leigh 1999 provides a strong argument that chrysotile asbestos is strongly associated with the health problems of the other forms of asbestos, and suggests there is no safe level.

The health problems associated with asbestos are primarily related to its fibrous nature. Most asbestos replacements are also fibrous. The toxic effects of the replacement fibres must be considered prior to accepting the replacement material.

Other literature (CSTEE 1998) suggest the little testing and research which has been conducted on the three main replacement fibres (Cellulose, PVA, P(ara)-aramid) suggests that they pose a lesser risk than chrysotile. This article does indicate the research is far from comprehensive, and cannot indicate the degree of health risk the asbestos replacements pose. Proponents of asbestos (AIC for example) use this fact to show that no reduction in safety precautions can be achieved by replacing asbestos with these substitutes.

HSE 1998, presents guide lines for importers, suppliers, manufactures, and uses of chrysotile to comply with the UK regulations relating to asbestos. This paper outlines the current regulations. It (the paper and/or the UK regulations) urge for the replacement of asbestos every where it is possible to do so, but also suggests " ... need to consider each case on its merits and be able to fully justify the decision."

Some proposed replacement materials have an inferior performance than chrysotile and hence may be prone to premature failure, with consequential risks to human life. This point is also noted in HSE 1998. Care is obviously necessary in developing replacement materials and re-engineering applications to ensure that safety is not prejudiced.

**Cost implications of asbestos replacement**

Asbestos has for many years proven to be a very versatile material. AIC 2, suggested 50 – 60 different substances would be required to replace the various uses of chrysotile fibre. The development and testing of this many substances would clearly be costly.

To temper this argument Hodgson, 1989 suggests alternatives would have to be found eventually as world supplies decrease driving the costs of asbestos up. So an accelerated replacement program may not be such a great burden as the pro-asbestos organisation may suggest. However, the indications are that much of the

development work has been done and satisfactory replacement materials developed for most applications.

## Conclusions and Recommendations

During the course of this study, no applications were found which required exclusions on technical grounds. The one application identified in the EU documentation as requiring special consideration was diaphragms for electrolysis. The literature suggested that there are technically feasible replacement materials, and this was confirmed with the industry. The European Union's concerns that this issue should be considered carefully and proposals for action negotiated specifically with the relevant organisations.

The applications of asbestos are so wide that it may be possible that critical applications do exist for which no suitable substitute is available. Recent developments in Europe and particularly UK show confidence that satisfactory replacement materials for chrysotile asbestos can be developed, given time.

The research and industry consultation conducted clearly indicated that asbestos is still being used. Existing plant and equipment is being maintained with replacement parts containing asbestos, imported and manufactured locally. It will therefore take some time to perform the application specific testing required to replace the asbestos parts.

The costs of re-engineering some equipment to use non-asbestos parts may be high and difficult to justify for low volume or superseded equipment. Therefore the economic consideration may be quite important.

In summary the available evidence confirms that a phase out of asbestos products in industrial applications is technically feasible but may require some time for complete conversion. There are some applications where safety is a concern and some short-term exclusions may be required. It is suggested that specific exclusions should require users to submit an application. This would allow uses of asbestos to be monitored and phased out over a reasonable period of time.

# ATTACHMENT 7

# CONSULTATION

The team consulted widely in preparing this report. The consultation was programmed to identify the key issues and provide sound data and information, but was not intended to be exhaustive.

The consultation revealed that there is a common recognition that the use of chrysotile asbestos would be phased out over time, and many organisations were planning on that basis. In the brake service sector, this was tempered to some extent by a "shop floor" view that asbestos materials still provided the best price/performance package.

Acheson A.N.Z. Pty Ltd

ACL Specialised Gaskets

ACT Brakes

Action Brake & Clutch

ACTU

Advanced Friction, NSW

AES Engineering Ltd

All Brake & Clutch Supplies

Australian Automobile Association

Australian Disc Brakes, NSW

Australian Trucking Association

Bendix Mintex

BMW

BP Refinery (Bulwer Island) Limited

BP Refinery (Kwinana) Proprietary Limited

Brake Bonders, Perth

Brisbane Bus Lines

Brisbane City Council Bus Fleet

British Friction Manufacturers Association

Burson Automotive, Vic

Bus Industry Confederation

Caltex Refineries (NSW) Pty Ltd

Caltex Refineries (Qld) Ltd

Capital Brake and Clutch, ACT

Carlisle Motion Control Aust. P/L

Carparts, NSW

Coventry Auto Parts, NSW

CSR Boral Castlereagh, NSW

Department of Environment, Transport and Regions, UK

Detroit Diesel Allison Australia Pty Ltd.

FCAI

Finemores Fleet Management

Flexitallic Group

Ford Motor Company of Australia

GE Aircraft Engines

GMH

GT Parts & Services

Hastings Deering - Brisbane

Haulmore Trailer Sales Pty Ltd

Hitachi America, Ltd.

Honeywell Aerospace Pty Ltd

Independent Brake Supplies, NSW

IOR Energy Pty Ltd

John Bell Transport Repairs

Lapillus Fibres, Netherlands

Meritor

Mobil Oil Australia

Molonglo Brake and Clutch, ACT

Motospecs, NSW

National Starch & Chemical Pty Ltd

NOHSC Member Agency Contact List

NRMA

Orica

Power Equipment Pty Ltd,

Powmat Ltd.

Pozzolanic Bulk Carriers

Qantas Engineering

QFM

Repco

Richard Klinger Pty Ltd - Head Office Perth

Rolls-Royce Australia Limited

Sawtell & Sons Pty Ltd

Sealing Technologies Pty

Sydney Buses Burwood Depot

Sydney Buses Willoughby Depot

Taro Distributors

Techseal Australia Pty Ltd

Tek-Motive Australia, Vic

Toyota

TriOcean Australia Pty Ltd

Uniqema Pty Ltd

Vivacity Engineering Pty Ltd

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