HEALTH AND SAFETY GUIDELINES FOR THE SELECTION AND SAFE HANDLING OF SYNTHETIC MINERAL FIBRES

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Contents

Objective

This guide has been prepared to provide practical guidance and as a statement of policy on safe working methods to be adopted when manufacturing or using synthetic mineral fibres (SMF).

This document largely follows the *National Code of Practice for the Safe Use of Synthetic Mineral Fibres,* published by Worksafe Australia in 1990, and their permission to reproduce material from that document is acknowledged. The assistance of the Electricity Corporation of NZ Ltd is also gratefully acknowledged.

This guide is intended to be read in conjunction with the Health and Safety in Employment Act 1992 and related regulations (in preparation at the time of publication). It does not replace or supersede the requirements of this legislation but provides guidance on how compliance can be achieved.

Introduction

Because of their similar application and appearance to asbestos, there has been concern about the health effects associated with exposure to synthetic mineral fibres (SMF). Concern in recent years as to the possible respiratory health hazards of SMF has lead to a number of comprehensive studies world-wide seeking to clarify the position.

It seems prudent not to regard SMF as simply a nuisance dust but rather as a potential hazard which requires sensible and appropriate precautions. The international literature will continue to report on the progress of long-term studies and already some differentiation is possible on the likely health effects of selected SMF such as ceramic fibres. This guide sets out what are seen as sensible minimum precautions which should be taken when using or working with any of the SMF, taking into account the state of the research.

Purpose

This guide sets out guidelines necessary to safeguard the health of people involved in the handling and use of synthetic mineral fibres (SMF). Requirements for respiratory protection are indicated, as well as guidelines for the selection of materials and the precautions necessary to safeguard health.

Scope

This guide applies to all applications involving mineral wool (rockwool and slagwool), glasswool (including superfine glassfibre) and ceramic fibres, and activities involving their manufacture, installation or removal or any related handling or work.

NOTE: Refractory brick can become degraded after prolonged use. The disturbance of such brickwork can produce dust which may contain fibres dangerous to health, and the procedures in this code should be followed for all work with refractory materials in this state.

This guide does not apply to the use of continuous glass filament which is used as a reinforcing agent in industries such as boat building and swimming pools. This product does not produce measurable levels of respirable fibre. The safe working practices for the use of this material require differing approaches to other forms of SMF, due to the associated use of material such as catalysts and resins.

Historical Background

Synthetic mineral fibre (SMF) is a generic term used to collectively describe a number of amorphous (non-crystalline) fibrous materials including glassfibre, mineral wool and ceramic fibre. Much of the international literature refers to SMF as 'man-made mineral fibres' (MMMF).

These products have been used for many decades. The major application of SMF is in thermal and acoustic insulation, and as a reinforcing agent.

In some specialised instances, these materials have been used as a replacement for asbestos, especially where high temperature insulation properties are required. Ceramic fibre has also been used to replace refractory brick and mortar materials.

Coarse mineral fibres can irritate the eyes and skin, and excessive inhalation of airborne SMF dust can irritate the upper respiratory tract. While later research has tended to discount the risk, in the case of fibreglass insulation there is evidence from early research to suggest that long-term adverse health effects may be attributed to SMF dust exposures in manufacturing situations.

Surveys indicate that, with reasonable housekeeping and dust control techniques, there should be no significant airborne concentration of dust. However, care still needs to be taken by those working with SMF.

Bibliography

- *Synthetic Mineral Fibres, National Code of Practice for the Safe Use of Synthetic Mineral Fibres,* published by Worksafe Australia, 1990.
- *Guidance Note on Man-Made Mineral Fibres,* Health and Safety Executive (UK), 1990.
- *Occupational Exposure, Toxic Properties and Work Practice Guidelines for Fiber Glass,* American Industrial Hygiene Association, 1991.
- *Workplace Exposure Standards and Biological Exposure Indices for NZ,* published by OSH, 1994.
- *A Guide to Respirators and Breathing Apparatus, published by OSH,* 1992.

Definitions

Calcium silicate is at present not classed as a SMF and dust from this material should be treated as a nuisance dust only.

Ceramic fibres are amorphous, glassy, predominantly alumino-silicate materials which are created from molten masses of either alumina and silica or naturally occurring kaolin clays. (Materials are made only from alumina and silica melts.) See also 'SMF'.

Glassfibre may be either reinforcing filament (not applicable to this guide), glasswool or superfine glassfibre.

Glasswool is a fibrous product formed by either blowing or spinning a molten mass of glass. The resultant fibres are subsequently collected as a mat of fibrous product which may either be bonded or non-bonded.

Gravimetric Standard is a standard based on the weight of material in a given volume of air (mg/m^3).

Inspirable is that fraction of dust which enters the respiratory tract.

Micrometre (l μm) represents one thousandth of a millimetre. (A strand of human hair is approximately 50 μm in diameter.)

Mineral wool is a fibrous product manufactured by the process of blowing or spinning from a molten mass of raw material. The resultant fibres are subsequently collected as an entangled mat of fibrous product. Mineral wool may be either slagwool, rockwool, or glasswool depending upon the raw material from which it is produced. See also 'SMF'.

Refractory ceramic fibre (RCF). See 'ceramic fibres'.

Respirable fibre is a particle with a diameter less than 3 micrometres and a length greater than 5 micrometres and a length to width ratio of greater than 3:1. These fibres can reach the deepest part of the lung.

Rockwool is a fibrous product manufactured by a process of blowing or spinning from a molten mass of rock, usually basalt. The resultant fibres are subsequently collected as a mat of fibrous product. See also 'SMF'.

Shall indicates that a requirement is mandatory.

Should indicates a recommendation.

Slagwool is a fibrous product manufactured by a process of blowing or spinning from a molten mass of metallurgical furnace slag. See also 'SMF. SMF means synthetic mineral fibres. These may be classified into three categories depending on their fibre diameter:

1. **Mineral wool:**

   (a) Rockwool, slagwool; and

   (b) Fibreglass with a mean fibre diameter greater than 3 micrometres, used for general insulation purposes.

2. **Ceramic fibre** with a mean fibre diameter of between 1 and 3 micrometres, typically used for high temperature insulation and fireproof expansion joints in the building industry and, increasingly, for general insulation.

3. **Superfine fibres** with a mean fibre diameter of less than 3 micrometres. Superfine fibres are used in highly technical applications such as aircraft manufacture and are rarely encountered in New Zealand.

Threshold limit values (TLV) for a wide range of substances have been published in New Zealand as Workplace Exposure Standards (WES). See 'WES' for definition.

WES-TWA (time-weighted average) is the 8-hour time-weighted average exposure of an airborne concentration of a particular substance. See also 'Workplace Exposure Standard'.

Workplace Exposure Standard (WES) represents the maximum airborne concentration of a particular substance in the worker's breathing zone, exposure to which, according to current knowledge, should not cause adverse health effects nor cause undue discomfort to nearly all workers. The exposure standard can be in three forms; time-weighted average (TWA), short-term exposure limit (STEL) or ceiling exposure limit (C).

Requirements

Statutory Requirements

All workplaces and work activities come under the Health and Safety in Employment Act 1992 which came into force on 1 April 1993. This Act puts the primary responsibility on the employer to provide a safe and healthy work environment by effectively managing any risk associated with the work.

Employers must systematically identify the hazards that are associated with work, and all significant hazards must be controlled. The Act requires that, where possible, significant hazards must be eliminated (this could include substitution by another material). Where a hazard cannot be eliminated or isolated, the effects of the hazard must be minimised. This guide sets out procedures which can be adopted to meet the requirements of the Act.

Health Hazards

SMF can cause irritation of the skin and eyes. In excessively dusty conditions, they may cause irritation of the upper respiratory tract. This risk increases with increased concentration of fibre in the air. Thus, SMF which has been incorporated into a stable bonded mat (and remains stable), presents no potential health risks unless disturbed by cutting, etc. Also important is the shape, size and durability of fibres.

Some people are particularly sensitive and they will need to take precautions to protect their skin.

Smoking may act to increase the adverse effect of some airborne substances in the workplace such as asbestos but there has been no proven link between SMF, smoking, and health effects.

Carcinogenic Effect

Because some SMF can contain fibres of respirable size, there has been concern about the long-term effects of inhalation, in particular carcinogenicity. The International Agency for Research on Cancer (IARC) has classified all SMF (i.e. glasswool, rockwool, slagwool and ceramic fibre) as “possibly carcinogenic to humans”. Independent studies commissioned by the mineral wool industry continue into the long-term effects. Early evidence appears to support industry action to have this classification downgraded to non-carcinogenic. At the time of publication of this guide the evidence is equivocal, with inconclusive evidence on both sides of the argument. Readers are referred to a literature review summary on the subject contained in appendix 2.

General Effects

In the short term, effects may vary from none to irritation of the eyes, nose, skin and respiratory tract. The extent to which health is affected will depend on the type, size, concentration and period of exposure to SMF.

Workplace Exposure Standard for SMF

The Occupational Safety and Health Service of the Department of Labour (OSH) publishes Workplace Exposure Standards for a wide range of substances.

These have been published as Workplace Exposure Standards (WES) effective from 1992 together with variations that apply in New Zealand.

The Workplace Exposure Standards adopted for SMF in New Zealand do not have specific legislative backing. However, they will be used by OSH as a guide to assess whether or not a factory or business premises is complying with the general requirements of the Health and Safety in Employment Act 1992.

The WES effective from 1992 is:

- 1 respirable fibre per ml; and
- 5 mg/m^3 inspirable dust.

The WES for SMF is expressed in two ways:

- As an airborne fibre limit; and
- As a gravimetric limit of total inspirable dust.

The limits are expressed in this way because the different forms of SMF and different processes produce different kinds of airborne dust. There is no fixed relationship between the two, with the gravimetric standard being appropriate for activities producing coarse dust and the fibre count limit for those producing mainly respirable fibres. For this reason, the gravimetric method will usually be the method of choice for most SMF. In cases of doubt, it may be necessary to make an assessment of the dust by initially using both methods to establish which of the standards is reached first. The relevant limit is the one which would be exceeded if the exposure was increased.

The WES are not fine lines between safe and dangerous concentrations, nor are they a relative index of toxicity, and this should be recognised when using these figures in a working environment.

The WES refers to airborne concentrations of substances and represents conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect. Because of wide variation in individual susceptibility, however, a small percentage of workers may experience discomfort from some

substances at concentrations at or below the WES. A smaller percentage may be affected more seriously by aggravation of a pre-existing condition or by development of an occupational illness.

Responsibilities

Duties of Employers

The Health and Safety in Employment Act 1992 requires employers to take all practicable steps to ensure the safety of employees, and to assess hazards in the workplace.

- Where the use of SMF materials is necessary, the type and product shall be selected so as to minimise the release of fibres and/or dust.
- Exposure to SMF shall be reduced to the lowest practicable level at all times by means of appropriate control strategies such as extraction ventilation systems in the manufacturing situation.
- Personal protective equipment shall not be used in place of other control measures unless these prove to be inadequate, impracticable or unworkable.
- Employees shall be instructed in safe working practices for handling SMF and, where necessary, correct procedures for the selection, wearing and maintenance of personal protective clothing and equipment where it is necessary to use this. The extent of instruction and training shall be appropriate to the duties of the individual within the organisation, and be sufficiently detailed to ensure that the individual understands not only the procedural and safety requirements, but also the reasons for these requirements.
- Information should be obtained as to the likely exposure levels that employees may experience. When monitoring is undertaken to determine exposure levels, such monitoring shall be in accordance with recognised methods, (see 'Selection of SMF Materials').
- Site maintenance procedures and good housekeeping practices shall be employed to ensure that the creation and spread of SMF dust is minimised and that SMF waste is disposed of as industrial waste in accordance with the requirements of this guide and the local authority.

Duties of Employees

- While at work, employees shall take care to protect their own health and safety, and the health and safety of any other person who may be affected by their acts at the workplace.

- Employees shall ensure that work is carried out in accordance with the practices in which they have been instructed.
- When required, employees shall wear the personal protective equipment supplied, in the manner in which they have been instructed.
- Employees shall report any observed work malpractices to their supervisor.
- Employees shall take part in any training and instruction programmes provided which is relative to the extent of their involvement with SMF materials.

Duties of Manufacturers

- The manufacturing process will need to be designed to ensure that the lowest amount of SMF dust as practicable becomes airborne. Adequate extraction ventilation must be fitted at all dusty locations and this equipment must be discharged via filtration devices or into collection bags for disposal in a safe manner. It is important that in the use or manufacture of SMF, dust extracted from the process does not result in a potential health impact on the neighbouring community.
- All SMF products must be packaged in materials which minimise the release of fibres. All such packaging should be clearly labelled with instructions for the safe handling of the contents.
- Manufacturers should produce, and make widely available to all users and suppliers, Material Safety Data Sheets (MSDS) for the SMF product.

Selection of SMF Materials

There are two basic forms of SMF insulation: bonded and unbonded. The bonded form involves the application of adhesives or cements as bonding agents to the fibre before delivery and the product has a specific shape such as pipe lagging. The unbonded form has no adhesives or cements and the fibre is loose material supplied in a package. The unbonded form can be installed loose or by wet spray, or mixed with adhesives or cements before, or during, installation. The presence of bonding agents significantly reduces fibre release during handling.

Some SMF materials employ a bonding agent which is designed to burn out during the first firing of the equipment in which it is installed, by which time the installation is secure. In these circumstances, instability and crumbling during subsequent product removal is a

cause for concern and emphasises the need for particular care when dealing with such materials.

The use of SMF has become established as an alternative to the use of asbestos. At present, there are no substitutes readily available for SMF products.

Products containing SMF should be selected for use on the basis of their temperature limitations as follows:

	Temperatures up to
• Glassfibre for an insulating surface	540^{o}C
• Rockwool for an insulating surface	650^{o}C
• Ceramic fibres for an insulating surface	1300^{o}C+

Before SMF materials are purchased, technical information and the Material Safety Data Sheet (MSDS) for the product being considered should be obtained and referred to in assessing the material's suitability and precautions to be taken when using the product.

Care shall be taken in selecting the form of material for the required purpose. By this means the requirement for cutting, shaping, etc. and extra handling can be avoided and the release of fibres reduced accordingly.

As an example, ceramic fibres of the alumino silicate type can undergo devitrification in service, particularly at temperatures above 1000^{o}C. Devitrification is accompanied by the formation of crystalline silica, which is potentially hazardous if it is released in a respirable dust form, e.g. by severe handling treatment. The extent of the formation of crystalline silica depends upon the composition of the ceramic fibres, and upon the thermal treatment. In general, the higher the service temperature and the longer the residence time, the greater the risk of formation of crystalline silica.

Some current manufacturers and trade names for glass wool, rockwool, and ceramic fibre materials are listed in appendix 1.

Basic Handling Policy

The three main factors which will determine the airborne fibre dust levels present when working with SMF are:

- The degree of disturbance of the material.
- The proportion of potentially inspirable fibres in the product.
- The presence of any binders or sealants.

Wherever SMF is used or handled (other than casual use), fibre levels should be kept to a minimum by:

- Training of employees in the need for care and in all aspects of working with and handling SMF materials.
- Supervising all SMF-related work to the degree necessary to maintain

the required standard of dust prevention and hygiene and ensuring that extraction ventilation control equipment, or appropriate personal protective equipment is used and maintained where it is necessary to limit exposure.

- Adopting good housekeeping and routine cleaning practices so as to avoid the unnecessary production of SMF dust and waste from any source, e.g. the maintenance of clean internal surfaces and floors, paying particular attention to open mesh flooring, voids, etc.
- The use of appropriate vacuum cleaning equipment. The best protection will be afforded by the use of equipment having a High Efficiency Particulate Air (HEPA) filter and kept specifically for this purpose.
- Sampling of work areas may be necessary to ensure that SMF dust concentrations are as low as is reasonably practicable and below the limits specified in the section 'Workplace Exposure Standard for SMF'.

The following practices will also assist in the control of SMF dust levels:

- Where possible, SMF material should be used in a form and shape which requires a minimum of cutting and handling on site.
- Packaging and transport of materials should be done so as to minimise the release of fibres and/or dust.
- Correct tools should be used for the task. Where required, manual tools should be used to trim or cut SMF materials. If power tools are used, these should be fitted with exhaust extraction at the point of dust generation, or other effective local exhaust ventilation should be provided.
- SMF materials should be stored in suitably marked containers or under covers, and containers should be opened only within the work area when work is to start.

Preparation of the Working Area

The area should be cleared, as far as is reasonably practicable, to facilitate removal of dust and debris on completion of the work.

Methods of Work

Working methods should be adopted which generate the least amount of dust, and inhibit the spread of dust to areas outside the working area.

Packaged insulation materials should be opened, and off-cuts and removed lagging should be bagged (in the work areas) during the work process. Debris should not be allowed to accumulate, and bagging should be done carefully to avoid the production of dust.

For ceramic fibre application and removal work, the following practices should be observed:

- Facilities should be available to allow workers to shower and change clothes after each work shift. Note: a work shift can be a varying

period of time which must be assessed at each situation.

- The working area should be cleaned as necessary with an appropriate vacuum cleaner. Good housekeeping has been shown to dramatically lower airborne levels of fibre. **Sweeping should NOT be used for cleaning up, nor should compressed air be used.** Washing down followed by wet mopping and wiping is an acceptable alternative if vacuuming is not practicable.
- SMF dust should be minimised by dampening or wetting of the material, where practicable, during removal or handling.

In all cases where unbonded refractory ceramic material is being removed or worked, it should be thoroughly wetted down unless electrical and/or heat considerations make dry working necessary. Removal of bonded material is easier and less hazardous. Any physical abrasion of SMF, including cutting, should be kept to a minimum during removal. Removal can be performed dry if physical abrasion is limited. If heat or other causes have made the bonded SMF adhere to the substrate, physical abrasion will be necessary, in which case removal should be performed as for unbonded SMF material.

Disposal of SMF Waste

Waste material from large jobs shall be placed directly into impermeable plastic bags. These bags shall be disposed of in bins or disposed of as industrial waste (not to be confused with asbestos through the use of 'Asbestos' labelled bags).

Disposal shall be in an approved landfill site operated by a local authority in accordance with the provisions of the Resource Management Act and local requirements.

Determination of SMF Dust Concentration Levels

If the procedures provided for in this guide are followed and appropriate work practices and good housekeeping standards maintained, employees should not be exposed to unsafe conditions or unacceptable risk to health from working with SMF and therefore monitoring of the working environment should not be necessary.

Whenever the nature of the work being carried out with SMF is such that concern exists regarding the possibility of unaccceptably high levels of inspirable SMF dust concentration, work practices should first be checked to ensure that all reasonable precautions are being taken. The determination of fibre levels can be checked by reference to any available information relating to jobs of a similar nature. Available information shall also be checked to determine whether the work has been previously assessed for typical fibre concentration levels.

It is good practice to carry out air sampling periodically in situations where exposure is continuous to check on the adequacy of controls. In other situations, or if concern still exists following the above checks, and at other times when exposures are considered to be uncontrolled, it is advisable to carry out an occasional check.

Sampling Methods

Sampling for airborne fibres can be carried out using the membrane filter method as used for asbestos dust levels, and sampling for total inspirable dust shall be collected according to the method set out in the Australian Standard AS 3640 *Method for sampling and gravimetric determination of inspirable dust* as set out in the WES booklet.

The analysis of the samples shall be carried out in accordance with the methods accepted for the estimation of airborne synthetic mineral fibres and inspirable dust by a laboratory which has TELARC accreditation for asbestos. The sampling and evaluation of SMF dust should be carried out by a person who has received instruction and training in the correct sampling techniques.

Identification of SMF Material

All classes of SMF should be identified where they are used in premises and establishments as an aid to managing how they will be handled should that become necessary.

As a means of identification, the SMF insulating material should be clearly marked externally, using the following suggested code:

- Fibreglass FG
- Rockwool RW
- Ceramic fibre CF

Respiratory Protective Equipment

While adequate and appropriate engineering controls should always be the preferred option, circumstances will arise where it may be necessary to work with SMF products or handle SMF materials using respiratory protection.

Airborne contaminants from SMF are all particulate in nature and therefore personal protection from lung-damaging respirable particles will be necessary. This will usually be achieved by selecting a half facepiece respirator with a minimum of a class P1 filter. A proper respiratory protection programme covering training, fit testing and maintenance should be developed in all work places where this form of control is used.

Information about the selection, use and maintenance of respiratory protective equipment is contained in the NZAS 1715: 1991 *Selection, use and maintenance of respiratory protective equipment*. A booklet *A Guide to Respiratory Protection is* also available from OSH branch offices.

Protective Clothing

Overalls

Disposable or single-use overalls complete with hoods are the preferred means of body protection for people working with SMF. Overalls that are close fitting at the neck wrists and ankles are preferred for SMF work to prevent problems of skin irritation. Lightweight nylon overalls can be used for this work and have the advantage that they can be laundered and used again. Where overalls are to be laundered, they should be laundered in separate laundry facilities and not in the home.

Gloves

Gloves should be worn when handling SMF materials, although it is not essential. People with sensitive skin will find gloves are necessary.

Eye Protection

When working with SMF materials, eye protection (goggles) may be worn as an aid to preventing irritation of the eyes. A positive-pressure air-fed respirator or full face piece will fulfil eye protection requirements and will be more comfortable to use.

Hygiene

Washing Up

Skin irritation can be minimised by good standards of personal hygiene. To prevent skin irritation the skin should be rinsed under cold to tepid (not hot) running water before the application of soap, which, if applied before sufficient rinsing, will have the effect of irritating the skin.

The provision of showering facilities may be necessary where SMF are removed from large industrial situations, e.g. removal of ceramic insulation from turbines, or on extra dirty jobs such as refractory replacement.

The ablution/showering facilities provided will normally include a shower, which should be easily accessible and conveniently located to the work area.

Health Monitoring

Employees working continuously with SMF shall be given the opportunity to have their health monitored by an occupational health nurse or physician. Where the work is intermittent, of short duration, or adequate control measures are in use, medical monitoring is not justified on health grounds. The most useful form of monitoring is lung function testing with a follow-up chest X-ray if function is deteriorating.

All medical records must be kept either by the examining physician or the worker, for 30 years after the date on which they ceased working with SMF.

Synthetic and Natural Fibre Insulation Products

While this guideline document is primarily about synthetic mineral fibres, the subject of insulation would not be complete without a brief mention of non-mineral fibres.

Recent additions to the range of thermal and acoustic materials available to the domestic and commercial industries are products manufactured from synthetic polyester fibres and wool/polyester blended fibres, thermally bonded to produce good thermal and acoustic properties.

The polyester products require no special handling precautions from a health and safety point of view. being both non-toxic and non-irritant.

Polyester fibres are man-made and manufactured from organic long chain polymers, and are used extensively in the apparel industry. They are commonly termed as man made synthetic fibres. Insulation made from this product in the form of a lightweight fibre wadding or blanket has thermal and acoustic properties and has no known physical or health hazards to users. The product is available in a range of thicknesses required to achieve “R” factors for insulation purposes. It conforms with New Zealand Standards for early fire hazard properties and is non-corrosive.

Products incorporating natural wool and polyester, where the products are bonded together by a heat process of thermal bonding, are also available and these have similar thermal and acoustic properties as the pure polyester product.

APPENDIX 1: Some Current Trade Names for Glasswool Materials in NZ

Company	TradeName/Form
Insulation NZ (INZCO)	Pink Batts
	Building insulation blanket
	Cosy Floor
	Sonomatt
	Noise control block
	Noise control blanket
	Noise control panel
	Noise control board
	Monocoustic
	Factory Liner
	Siliner Ductliner
	Ductwrap
	Hush Duct
	Flexible Equipment Insulation (FEI)
	Lightweight Equipment Insulation (LEI)
	Intermediate Service Board (ISB)
	Rigid Equipment Insulation (REI)
	Pre-formed pipe sections
	Flex Wrap
	Appliance insulation
	White Wool
Bradford	Gold insulation
	Thermal insulation blanket

Some Current Trade Names for Rockwool Materials

Company	Trade Name/Form
Bradford	Fibretex Rockwool
	Fibretex Ductliner
	Fibretec Acoustic Baffles
	Fireseal Loos

	Fireseal Fire
	Damper strips
	Fibretex Spraywool
	Fibretex Granulated
	Fibremesh
	Fibremesh Pipe Wrap
	Cavity wall insulation
	Thermaclad
Bells Thermalag	KBSsealbags
	Thermaspray
Roberts Fire Protection	M34 mineral fibre
	HT mineral fibre
	BD6 hard-set cement
	FP/GP mineral fibre
NZC0	Rocwool
	CAFCO
	Insulroc
	Thermospray

Some Current Trade Names for Ceramic Fibre Materials

Company	**TradeName**	**Form**
Carborundum	Fibrefrax	Bulk loose
		Durablanket
		Duraboard
		Felt and paper
		Rope and braid
		Textiles
		Cement and mixes
Morganite	Kaowool	Ceramic Fibres Bulk loose
		Blanket
		Board
		Modules
		Blanket modules
		Cements and coatings

		Mastic
		Rope and textiles
		Felt and paper
Bells Thermalag	Kaowool	Ceramospray I
		Ceramospray LAL
		Ceramocote I
Pyrotek	Various	Pyrotek M6 felt
		Pyrotek J1 rope
		Pyrotek U1 millboard
		1 Pyrotek M13
		Fibreseal board
FHC Valves and Insulation	Nefalit	Milboard
ICI	Saffil	Saffil bulk fibre
Manville	Cerafibre	Cerablanket
		Ceraboard
		Cerawool
		Cerachem
INZCO	Cerakwool	Cerakwool blanket
		Cerakwool rope
		Cerakwool board
		Cerakwool paper
		Cerakwool bulk

Some Current Trade Names for Synthetic Fibres

Company	**TradeName/Form**
INZCO	Comfort Zone
	Wool Line
Woolhouse	Thermofleece
	Acoustifleece

APPENDIX 2: Synthetic Mineral Fibres (SMF) — A Literature Review

A literature review with assessment of likely human risks in the user industries, and comments on the New Zealand Draft Guidelines undertaken by Dr D M G Beasley, National Toxicology Group, Poisons Centre Dunedin.

Ideally, one should not rely totally on the findings from animal studies in predicting risk to humans, particularly when setting exposure standards. However, the available epidemiological studies, although well executed, do present difficulties for interpretation partly because of unresolved controversy regarding the levels of exposure in the past and other possible significant chemical exposures; plus the relatively small SMF increases make it difficult to be totally sure that other biases are not the explanation. Therefore, both approaches should be utilised and special significance be attached when they appear to be in agreement. I believe that in this context there is much that is encouraging. Thus, it is reassuring that the epidemiological studies have not demonstrated any convincing increased risk for glass wool production workers, nor for rock/slag wool workers exposed only in the late technological phase. The epidemiologists suggested that the difference could have been the probable higher levels of rock/slag wool compared to glass wool in the early days. However, the experimenters point to the higher fraction of respirable fibres in rockwool/slagwool, and their longer survival in the lung than glasswool. Whatever the explanation, and it may be a combination of factors, the point is that it is reassuring in terms of the glasswool industry.

Animal inhalational studies are becoming increasingly sophisticated, and recent results are reassuring particularly when SMFs are considered in relation to asbestos. In 1988, the World Health Organisation had cautioned that while none of the inhalation studies had shown a statistically significant increase in lung tumours, only relatively few had been completed, sometimes using only small animal numbers, with some, in fact, showing minor, albeit non-statistically significant, increases. Since that time, a number of larger studies have confirmed no significant excess of lung tumours from SMFs (with the notable exception of refractory ceramic fibre). In my view, these findings tend to overshadow the rather equivocal results of the epidemiological studies.

In the problematic area of standard setting, I believe the proposed WES is reasonable. The respirable fibre limit is the same as that currently set for chrysotile. This has been shown to induce fibrosis and lung cancer at significant rates in animal studies, unlike SMFs, and its respirable fraction is higher and lung durability greater. Ceramic fibre (and possibly, if they are used, superfine fibres, due to their small fibre diameter) warrant special attention. It could be noted that estimates of previous levels in the plants studied epidemiologically were only of this order, i.e. 1 to 2 fr/mL estimated as the mean during the early phase, the time which may have been a proble However, it was pointed out

that higher levels would have occurred at times, and a standard equalling that of chrysotile is more than adequate. It has been pointed out that it is not, in fact, difficult to achieve these levels with virtually any process involving the insulation wools.

Thus, the following are typical insulation wool fibre levels (fibres/mL) currently found with different situations:

Manufacture	0.04
Cutting pipe	0.02
Ductboard	0.05
Installation	0.01
Home batts	0.03

Although the mechanism of carcinogenesis of asbestos is poorly understood, the risk is dose-related and it is highly likely this would apply to other fibres. The balance of evidence suggests that a WES of l fr/mL will provide ample protection against many types of SMF, and that furthermore this standard should not be difficult to achieve. It may be, however, that ultimately different standards may be required for different types of SMF.

The New Zealand Draft Guidelines adopt a somewhat different approach, stressing that health and hygiene issues should influence the **selection** of the type of SMF to be used, and that exposures should be reduced to the **lowest practicable level,** in effect adopting extra precautions in the face of (albeit decreasing) uncertainties about exact risk levels. This is entirely reasonable. It also identifies specific problems, such as the formation of crystalline silica from ceramic fibres of the alumino silicate type with sustained high temperatures. Thus, it seems reasonable that where ceramic fibres need to be used (at temperatures of 650^{o} to 1300^{o}C), types other than alumino silicate should be considered. Such choices cannot be made without adequate information on products, and a specified minimum amount of data should be available on MSDSs. The draft code provides useful advice on the preferred form, shape, packaging, and transport of SMFs; plus preferred working tools, vacuum and ventilation systems and housekeeping practices. There is some evidence from the epidemiological studies which would lend support to the extra precautions for SMF without binding agents.

Some at least of the published information on fibre levels suggests that monitoring should rarely disclose problems and should not need to be frequent. It also implies that respirator nominal protection factors should not need to be high and protective equipment will not need to be as sophisticated as that recommended for asbestos. Clearly, greater protection, including to the eyes, is afforded by full-face masks or positive-pressure helmet respirators. Simple lung function tests are probably the most useful form of health monitoring. While most evidence suggests significant changes are unlikely, the question is not completely resolved and periodic monitoring is a sensible precaution, facilitating as it also does aspects of worker education. Chest radiographs may be indicated in the event of deterioration in test results.