

PETRONAS TECHNICAL STANDARDS
HEALTH, SAFETY AND ENVIRONMENT

MAN-MADE MINERAL FIBRES
(GUIDELINE)

JUNE 2006

PTS 60.1502.05
Rev 1



PREFACE

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AMENDMENTS RECORD SHEET

Chap. No.	Sect No.	Description	Issue No.	Date	Rev No.	Date	App by: (initial)
All	All	PTS 60.069 MAN MADE FIBRES	1	Sept 04	0	0	IGA

Chap. No.	Sect No.	Description	Issue No.	Date	Rev No.	Date	App by: (initial)
All	All	PTS 60.069 MAN MADE MINERAL FIBRES	1	June 05	0	0	IGA

Chap. No.	Sect No.	Description	Issue No.	Date	Rev No.	Date	App by: (initial)
All	All	PTS 60.1502.05 MAN MADE MINERAL FIBRES	2	June 06	1	June 06	IGA

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1. INTRODUCTION

Man-made mineral fibres (MMMF) are extensively used as thermal insulation mainly as a substitute for asbestos and asbestos containing materials.

Although it is generally accepted that MMMF present only a low risk to health, concern does currently exist because in animal tests the fibres have shown an effect similar to asbestos. For this reason, it is advisable to minimize any exposure.

The principal objective of this document is to provide guidelines to PETRONAS on the selection and safe handling of MMMF, which may serve as a basis for management to draft local codes of practice. The recommendations should be regarded as general requirements and should be read in conjunction with local statutory regulations where they exist.

2. SUMMARY OF RECOMMENDATIONS

- 2.1** While the present scientific evidence indicates only a low historical risk of human cancer from exposure to MMMF the implication of animal studies conducted to date cannot be ignored. It is considered prudent therefore to regard MMMF with caution and it is recommended that:

good industrial hygiene practice should be followed in order to keep exposures as low as practicable.

- 2.2** For the purpose of this guide and in the absence of any national regulation, the following occupational exposure limits are recommended:

exposures to MMMF should be kept as low as practicable preferably below 1 respirable fibre per ml of air and in all circumstances below 5 mg of total inhalable dust per m³ of air.

- 2.3** A combination of engineering controls, personal protection and good hygiene practices will ensure that exposures are maintained as low as practicable.

- 2.4** Waste MMMF should be handled in a controlled manner to minimize potential exposure. The material should be placed in plastic bags, sealed and labeled and buried at an approved site.

3. CLASSIFICATION OF MMMF

3.1 GENERAL ASPECTS

For the purpose of this document man-made mineral fibres (MMMF) refer to those fibres which are manufactured from natural rock or other minerals, from readily melted slags, from glass and from metallic oxide fibres. They can be classified in four groups

- Insulation wools;
- Refractory or ceramic fibres;
- Continuous filament fibres;
- Special purpose fibres.

These groups may be characterized by their dimensions (nominal diameters). Since fibre morphology (the size and shape of the fibres) is more significant than the chemical composition of durable fibres (retained in the body) in terms of risk to health, then this characterization may be particularly important. They are further subdivided according to their source material; i.e. slag wool, rock wool, glass wool, ceramic, alumina, by their usage and by the dimensions of the fibres (see Figure 1 below).

When considering the information given in Fig.1, it is important to note that the data are derived from a variety of methods which are based mainly on optical techniques. Such techniques under estimate the content of fibres having a diameter of less than 3µm. In practice insulation wool, refractory fibre and continuous filament can be expected to have fibres of less than this value, i.e. respirable fibres.

Figure 1
Classification of man-made mineral fibres.*

(INSERT TABULATION HERE)

3.2 INSULATION WOOLS

These are considered separately as slag wool, rock wool and glass wool. They are wool-like silicate fibres used predominantly for thermal and acoustic insulation purposes. Collectively they are referred to as "mineral wool".

Slag wool; is made from the slag produced in metal manufacturing.

Rock wool; is mainly produced from naturally occurring igneous volcanic rock such as basalt or dolomite. Some rock wools contain lime which is added as a flux.

Glass wool; glass wool is manufactured from boro-silicate type glass containing varying amounts of soda lime and alumina. The composition depends on the end use of the product and on the fiberizing process employed. After manufacture 'glass wools' contain no significant amount of free silica and are substantially amorphous.

Insulation wools are used for a variety of industrial and domestic applications. They also find wide application as acoustic absorption materials. To a lesser extent they are used for spinning yarn and for weaving into cloth for filtration fabrics. For insulation purposes these wools are restricted to temperatures below 500°C.

Mineral wools currently used for general insulation purposes have a mean fibre diameter of about 49 μ m including some respirable fibres.

For thermal insulation purposes the fibres are treated with a binder, commonly a thermo-setting resin of the phenol-formaldehyde type. Fibres used for weaving into fabrics may be produced with a lubricant and for some special applications they may be manufactured without any binder. The dustiness of the basic product is strongly influenced by the application of a binder and may vary with formulation and quantity used.

3.3 REFRACTORY OR CERAMIC FIBRES

Generally these are manufactured by melting kaolin clay at temperatures around 2,000°C and blowing' the melt to produce fibres. Purer forms are made by using alumina and silica as the feedstock. Technically these fibres are alumino-silicate glass and they contain no significant amount of free silica.

Recent developments include the production of micro crystalline fibres of alumina and a product manufactured from zirconium oxide. The latter product is used in high-temperature insulation applications.

Alumina and zirconia fibre products are sometimes referred to as refractory fibres to distinguish them from the alumino-silicate ceramic fibres. Ceramic fibres have a mean fibre diameter of 2-3 μ m including some respirable fibres.

3.4 CONTINUOUS FILAMENT FIBRES

Continuous filament fibres are produced exclusively from glass and mainly from borosilicate glass. Soda lime and alumina are also added depending on the type of product manufactured.

Alkali-resistant fibres which have recently been introduced are of zircono-silicate type. After manufacture the glass fibres contain no significant amounts of free silica. Continuous filament fibres are woven into cloth or used in the form of roving or chopped strand for the manufacture of electrical insulation products and as a reinforcing agent in plastic and cement products.

The mean fibre diameter of continuous filament fibres varies depending on end use of the product:

- for electrical insulation 6-9.5 μ m
- reinforcing mat 9-9.5 μ m
- chopped strand 12-14 μ m

Airborne respirable fibres have been found where continuous filament fibres are