

GUIDE TO HANDLING REFRACTORY CERAMIC FIBRES

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safe work australia



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1. INTRODUCTION

1.1 Who should use this Guide?

This Guide provides information for persons conducting a business or undertaking on how to manage health and safety risks associated with using and removing materials containing refractory ceramic fibres (RCF) and other high biopersistence fibres (HBF).

This Guide does not cover glass, slag or rockwool fibres or fibres which pass low biopersistence tests and do not have carcinogenic potential.

This Guide should be read together with the *Workplace Exposure Standards for Airborne Contaminants*. This document contains a list of exposure standards that apply under the Work Health and Safety (WHS) Regulations and information about their interpretation and use.

1.2 What are Refractory Ceramic Fibres and High Biopersistence Fibres?

RCF are a sub-category of man-made vitreous fibres (MMVF) manufactured for high temperature, high performance thermal insulation applications and used mostly to line furnaces, kilns and other industrial heaters. They are also used as an insulation medium or thermal barrier in the automotive, marine, petrochemical, steel, aluminium, ceramic, glass and construction industries.

RCF are made from kaolin, a naturally occurring alumino-silicate clay or a synthetic mix of alumina and refined beach sand.

HBF are MMVF which do not break down in the lungs and are considered to pose similar health risks as RCF. Whether a fibre is high biopersistence or not is determined by toxicological testing. Fibres which are not glass, slag or rockwool and have not been tested should be assumed to be HBF.

A list of common types and applications for RCF and HBF is in Appendix A.

1.3 What are the effects of exposure to Refractory Ceramic Fibres and High Biopersistence Fibres?

RCF and HBF are classified as being presumed to have the potential to cause cancer by inhalation.

Many RCF and HBF products that do not contain binders are dusty and can release inhalable fibres when being used. Inhalable fibres can irritate the throat, eyes and upper respiratory tract.

For some people RCF and HBF exposure can irritate and redden the skin. This effect is normally temporary and should reduce over time. Fibres can also be caught under the eyelid and scratch the cornea.

1.4 Who has health and safety duties?

People who carry out activities which involve handling RCF and HBF as part of their business or undertaking have duties under the model work health and safety laws.

Table 1 Health and safety duties for handling Refractory Ceramic Fibres and High Biopersistence Fibres

Who	Duties	Provisions
A person who conducts a business or undertaking	<ul style="list-style-type: none"> ■ Ensure, so far as is reasonably practicable, workers and other people are not exposed to health and safety risks arising from the business or undertaking. ■ Ensure no person at the workplace is exposed to RCF or HBF at an airborne concentration that exceeds the exposure standard for RCF or HBF. ■ Eliminate risks to health and safety so far as is reasonably practicable, and if this is not reasonably practicable, minimise those risks so far as is reasonably practicable. <p>This includes risks associated with using, handling and storing RCF and HBF, as well as other hazards associated with working with RCF and HBF.</p>	<p>WHS Act s 19</p> <p>WHS Regulations r 49</p> <p>WHS Regulations r 35</p>
Designers, manufacturers, importers, suppliers or installers of plant or substances	Ensure, so far as is reasonably practicable, the plant or substances they design, manufacture, import, supply or install is without risks to health and safety including carrying out testing and analysis and providing information about the risks posed to users of the plant or substances.	WHS Act s 22-26
Officers, for example company directors	Exercise due diligence including by taking reasonable steps to ensure the business or undertaking has and uses appropriate resources and processes to eliminate or minimise risks from RCF and HBF.	WHS Act s 27
Workers	Must take reasonable care for their own health and safety and not adversely affect the health and safety of other people. Workers must comply with reasonable instruction and co-operate with any reasonable policy or procedure relating to health and safety at the workplace.	WHS Act s 28
Other persons at the workplace	Must take reasonable care for their own health and safety and take reasonable care not to adversely affect other people's health and safety. Other persons at the workplace must comply, so far as they are reasonably able, with reasonable instructions.	WHS Act s 29

1.5 What is involved in managing risks?

You should manage the risks associated with RCF and HBF by following a systematic process which involves:

- identifying hazards – find out what could cause harm
- assessing risks if necessary – understand the nature of the harm that could be caused by the hazard, how serious the harm could be and the likelihood of it happening
- controlling risks – implement the most effective control measures that are reasonably practicable in the circumstances, and
- reviewing control measures to ensure they are working as planned.

This process must, so far as is reasonably practicable, be carried out in consultation with workers who are or are likely to use materials or plant containing RCF and HBF.

Further guidance on the risk management process is in the Code of Practice: *How to manage work health and safety risks*.

1.6 Consultation

Consultation involves sharing information, giving workers a reasonable opportunity to express views and taking those views into account before making decisions about health and safety matters.

Consultation with workers and their health and safety representatives is required at each step of the risk management process. By drawing on the experience, knowledge and ideas of your workers you are more likely to identify hazards and choose effective control measures.

You should encourage your workers to report hazards and health and safety problems immediately so the risks can be managed before an incident occurs.

Further guidance on consultation is available in the Code of Practice: *Work health and safety consultation, co-operation and co-ordination*.

2. MANAGING REFRACTORY CERAMIC FIBRES AND HIGH BIOPERSISTENCE FIBRES HEALTH AND SAFETY RISKS

2.1 Identifying the hazards

It is not always possible to visually distinguish between products containing RCF or HBF from low biopersistence fibres, although they commonly are used for different applications. It is important the composition be confirmed before use or removal.

A product's composition can be checked by looking at the safety data sheet (SDS) and product label (see Figure 1) or with the manufacturer. Materials already installed can be tested by a laboratory or test kit supplied by the manufacturer or distributor. If in doubt you should assume the insulation product is RCF or HBF and follow the handling procedures in this Guide.

Asbestos is not usually used in the same situations as RCF and HBF, but if the installation is old or you are unsure if asbestos is present, you should have the suspected material identified by a competent person before starting work.

2.2 Assessing the risks

A risk assessment involves considering what could happen if someone is exposed to a hazard—in this case RCF or HBF—and the likelihood of it happening. Factors to consider when assessing the risks include:

- Is the RCF or HBF in a location accessible to workers? Does it contain binders? Is it encapsulated or in a bound state? Is it aged and friable due to long periods at high temperature or is it physically damaged?
- How much RCF or HBF is there? How much dust is likely to be produced?
- How long will the job take?
- Who could potentially be exposed to dust, for example workers, passers-by or sub-contractors?
- What is the work area like? Is it difficult to move around or poorly ventilated? Could the dust travel out of the area?
- What action should be taken to control the risk? Should the material be removed?
- How urgently is the action to be taken? When will work be carried out?
- Are existing control measures effective? Is dust minimised by existing controls?
- Are procedures adequate to control exposure to dust below the exposure standard? Regardless of the exposure standard, exposures must be minimised so far as is reasonably practicable.

Many hazards and their associated risks are well known and have well established and accepted control measures. In these situations the second step to formally assess the risk is unnecessary. If after identifying a hazard you already know the risk and how to control it effectively, you may simply implement the controls, for example those recommended in section 2.3.

WORKPLACE EXPOSURE STANDARD AND AIR MONITORING

Worker exposure to RCF and HBF must not exceed both the 8 hour time-weighted average (TWA) value of 0.5 respirable fibres/mL and the 8 hour TWA inhalable dust workplace exposure standard of 2 mg/m³. The risk of exposure must also be minimised so far as is reasonably practicable.

2. MANAGING RCF AND HBF HEALTH AND SAFETY RISKS

Air monitoring must be carried out to determine the airborne concentration of a substance if:

- you are not certain on reasonable grounds whether or not the airborne concentration of the substance or mixture at the workplace exceeds the relevant exposure standard, or
- monitoring is necessary to determine whether there is a risk to health.

When monitoring airborne contaminants is used to estimate a person's exposure it must be done in the breathing zone of the person.

Analysis of air monitoring samples taken in the workplace should be carried out by a National Association of Testing Authorities (NATA) accredited laboratory. A list of accredited laboratories is available from the NATA web site at www.nata.asn.au.

Once levels of respirable fibres and inhalable dust levels are determined for a given work area or process, further monitoring may only be needed to check control measures are effective provided the work practices remain the same.

Further guidance on exposure standards is in Safe Work Australia's *Workplace Exposure Standards for Airborne Contaminants*.

2.3 Controlling the risks

Some control measures are more effective than others at reducing the risk of exposure. Control measures can be ranked from the highest level of protection and reliability to the lowest. This ranking is known as the hierarchy of control.

Specific advice on control measures to use during work which poses the highest risk of exposure to RCF or HBF, for example removal of RCF or HBF from plant or structures, is provided in Chapter 3.

ELIMINATING THE RISK OF EXPOSURE

Eliminating the risk means removing the hazard or hazardous work practice from the workplace. This is the most effective control measure and must always be considered before anything else. For example, modify the structure or plant in the design phase so RCF or HBF is not required, or substitute material containing RCF or HBF with low biopersistent fibre product having the required performance characteristics.

If eliminating the risk is not reasonably practicable you must use substitution, isolation or engineering controls, or a combination of these control measures, to minimise the risk so far as is reasonably practicable.

MINIMISING THE RISK OF EXPOSURE

Substitution

Minimise the risk by substituting or replacing a hazard or hazardous work practice with a safer one. For example, substituting an uncut RCF or HBF product with a pre-cut or pre-shaped product will minimise the risk of dust and fibre release. You could also consider using an encapsulated form of an RCF product.

Isolation

Minimise the risk by isolating or separating the hazard or hazardous work practice from people. For example, isolating material or plant containing RCF or HBF so dust and fibres are unable to travel outside the work area.

2. MANAGING RCF AND HBF HEALTH AND SAFETY RISKS

Engineering controls

Engineering controls are physical control measures to minimise risk, for example:

- using extraction and ventilation systems to prevent dust and fibre dispersion
- wetting products with a fine clean mist of water before and during use but only where there is no risk of electric shock and no live wires are present
- storing material in original packaging and only opening packaging when needed, and
- repacking and safely storing RCF or HCF materials not fully used to prevent dust and fibre release.

If a risk then remains, exposure must be further minimised so far as is reasonably practicable by using:

Administrative controls

Administrative controls should only be considered when other higher order control measures are not reasonably practicable or to increase protection from the hazard. Examples of administrative controls include:

- regularly inspecting and maintaining ventilation systems and dust collectors
- clearly identifying areas where material or plant containing RCF or HBF are used
- restricting access to people who have been trained and are competent to use material or plant containing RCF or HBF
- prohibiting the use of compressed air, high pressure water spray and dry brushing for cleaning
- mandating the use of hand tools or low power tools with local exhaust ventilation to minimise dust creation
- limiting workers accessing either directly or indirectly material or plant containing RCF or HBF to authorised workers, and
- keeping only the minimum amount of material containing RCF or HBF at the workplace.

Any remaining exposure risk must be minimised, so far as is reasonably practicable, by providing and ensuring the use of:

Personal protective equipment

Personal protective equipment (PPE) is the lowest order control measure in the hierarchy of controls. PPE should only be considered when other higher order control measures are not reasonably practicable or to increase protection from the hazard.

A person conducting a business or undertaking must provide workers with PPE if other control measures do not minimise exposure. Workers must be trained to fit and use PPE so it remains effective in controlling the risk.

Table 2 sets out the PPE recommended when handling materials or plant containing RCF or HBF.

2. MANAGING RCF AND HBF HEALTH AND SAFETY RISKS

Table 2 Personal Protective Equipment for handling materials or plant containing Refractory Ceramic Fibres or High Biopersistence Fibres

Item	Recommendations
Protective clothing	<p>Workers should be provided with and wear protective clothing suitable to the work type to prevent skin and eye irritation, for example disposable lightweight overalls worn over normal clothing. Tight cuffs or collars should be avoided as they can cause irritation by rubbing fibres into the skin.</p> <p>Protective clothing should:</p> <ul style="list-style-type: none"> ■ be long sleeved ■ be removed before removing respiratory protective equipment (RPE) ■ where disposable, be placed in a sturdy plastic bag and disposed of in line with Chapter 4 of this Guide, and ■ if reusable, be placed in a sturdy plastic bag and laundered separately from other clothing to prevent fibres being transported onto other garments. <p>Protective clothing should not be:</p> <ul style="list-style-type: none"> ■ taken home, or ■ cleaned by compressed air in an attempt to remove adhering fibres. <p>Changing arrangements should be designed to minimise dust and fibre exposure during dressing and undressing.</p>
Respiratory Protective Equipment	<p>RPE should be used only as a temporary control measure— i.e. for short-term exposure which is otherwise difficult to control and where concentrations are unknown. RPE should not be used as a long-term solution.</p> <p>A Class P1 or P2 respirator should be worn during work in enclosed or poorly ventilated spaces, for example inside kilns and furnaces or where evidence suggests dust and fibre levels are likely to exceed the exposure standards. Face pieces should be cleaned and disinfected and placed in a sealed plastic bag or stored in a dust and fibre free environment after each use.</p> <p>RPE should comply with AS/NZS 1716-2003: <i>Respiratory protective devices</i> and be selected, used and maintained in accordance with AS/NZS 1715-2009: <i>Selection, use and maintenance of respiratory protective devices</i>.</p>
Head, hand and eye protection	<p>Gloves should be worn when installing and removing material containing RCF or HBF.</p> <p>When carrying out overhead work, goggles and a head covering should be worn.</p> <p>Gloves, hats and goggles should be cleaned after each use. They should be stored in a dust and fibre free area and replaced when necessary.</p>

2. MANAGING RCF AND HBF HEALTH AND SAFETY RISKS

COMBINING CONTROL MEASURES

In most cases a combination of control measures will provide the best solution to minimise the risk to the lowest level reasonably practicable. For example, combining:

- isolation – enclosing plant which manufactures RCF or HBF
- engineering – using dust extraction with filtration on the enclosed plant
- administrative – restricting plant access to trained workers for the purposes of cleaning and maintenance, and
- PPE – ensuring appropriate PPE is worn at all times.

AVOIDING THE SPREAD OF RCF OR HBF CONTAMINATION

Dust and fibres can be spread from their source throughout the workplace. To avoid this you should:

- take reasonable steps to ensure food, drink, chewing gum or smoking materials are not taken into a workplace where they may be contaminated with RCF or HBF
- keep amenity rooms free of dust and fibres if possible
- provide and maintain in good working order change room facilities for washing and showering
- only use high efficiency particulate air (HEPA) filtration vacuum cleaners to prevent dust and fibres re-entering the atmosphere when cleaning. If this is not possible clean by wet sweeping or wiping, and
- take particular care to ensure dust and fibres are not released when emptying vacuum cleaners or waste bins or in the subsequent disposal of the dust and fibres.

2.4 Information, training, instruction and supervision

Before material or plant containing RCF or HBF is used you must provide workers with the information, training, instruction and supervision necessary to protect them from risks to their health and safety. Information should include the possible hazardous health effects to the lungs and irritation to the skin, eyes and throat.

Information, training and instruction must take into account:

- the nature of the work carried out by the worker
- the nature of the risks associated with the work at the time of the information, training and instruction, and
- the control measures implemented.

Information, training and instruction must be provided in a way that is readily understandable by any person to whom it is provided.

Workers should be trained:

- to use control measures effectively and safely to minimise inhalation of dust and fibres
- how to minimise skin and eye contact with RCF or HBF materials, and
- how to wash after handling RCF or HBF.

2.5 Reviewing control measures

Control measures to minimise exposure to fibres should be reviewed regularly to make sure they are effective. Work processes often change and can significantly alter exposure levels. The review can be done by using the same methods as the initial hazard identification process. Common methods include inspecting the workplace, consulting, testing and analysing records and data. Reviewing control measures also involves considering whether a higher order control measure is now reasonably practicable.

You must review control measures and if necessary revise them:

- when the control measure is not effective in controlling the risk
- before a change at the workplace that is likely to give rise to a new or different health and safety risk the control measure may not effectively control
- if a new hazard or risk is identified
- if the results of consultation indicate a review is necessary, or
- if a health and safety representative or worker requests a review.

If problems are found go back through the risk management steps, review your information and make further decisions about control measures.

3. REMOVING REFRACTORY CERAMIC FIBRES FROM PLANT OR STRUCTURES

Before removing RCF material from plant like furnaces, kilns and boilers you should determine what extra control measures are needed. Control measures to remove RCF may differ depending on whether the material:

- is in the same condition as when it was installed, and
- has been subjected to sustained high temperatures.

Removing RCF material from plant that has been maintained at temperatures exceeding 900–1100°C for a long time, for example months, may create extra hazards and risk. This is because dust from bricks and mortar with high silica content—not the RCF itself—may have been converted to crystalline silica and be present in the fibrous material to be removed.

High concentrations of RCF material may be generated when products are mechanically disturbed. Furnace dismantling and rebuilding operations, for example removing furnace lining insulation at the end of its service life can produce high concentrations of dust and fibres. This is because:

- after use RCF material becomes brittle and is friable i.e. is in a powder form or can be crumbled, pulverised or minimised to a powder by hand pressure when dry
- a large volume of material may be removed, and
- removal takes place in a confined, enclosed or poorly ventilated space, often with inadequate dust and fibre extraction.

Further guidance on confined spaces is available in the Code of Practice: *Confined spaces*.

Control measures for the removal of this type of RCF or HBF material may include:

- enclosing or isolating the removal work area to avoid contaminating nearby workplaces
- clearly identifying the removal area and installing barriers to stop unauthorised access
- providing workers with a full face Class P3 respirator or if this is not possible, providing suitable dust and fibre extraction during the removal process. When considering whether a full face class P3 respirator is appropriate, the risk of heat stress and the duration of the task must be considered. If there is a risk of heat stress or the task duration is long, a powered air purifying respirator may be required, and
- providing powered air purifying respirators depending on the level of exposure or where there is complex access and worker movement is required.

4. WASTE DISPOSAL

Waste and scrap material containing RCF or HBF should be transferred to strong and durable containers.

You should consult your local waste disposal authority about whether they accept the waste. Where the waste containing RCF or HBF has been contaminated by other hazardous waste, guidance should be sought from an expert in hazardous waste management.

LABELLING

The containers should be sealed and clearly labelled using the *Globally Harmonised System of Classification and Labelling* (GHS) label elements set out in the WHS Regulations.

As a minimum waste containers or bags should be labelled with a product identifier, the name, address and contact details of the person conducting the business or undertaking generating the waste, the GHS hazard pictogram, GHS signal word and the GHS hazard statements. As much information as possible about the waste material should be provided. This can also include relevant precautionary statements, first aid and other safety directions. An example of what should be included on a label is in Figure 1.

Table 3 Example of label elements for Refractory Ceramic Fibres waste

Example of label elements for Refractory Ceramic Fibres waste	
Product identifier	Product (Contains: XYZ)
Pictogram	
Signal word	DANGER
Hazard statement	May cause cancer. May irritate skin and eyes.
Suggested precautionary statements	<p>Do not breathe dust.</p> <p>Do not use until safety precautions have been read and understood.</p> <p>Use personal protective equipment as required.</p> <p>Wash hands thoroughly after handling.</p> <p>If exposed or concerned: Get medical advice and attention.</p> <p>Dispose of contents in accordance with local regulations.</p>
Details	My Company, My Street, My Town, My State, 0000
Telephone	Tel: (99) 9999 9999

Further guidance on labelling hazardous waste is available in the Code of Practice: *Labelling of workplace hazardous chemicals*.

APPENDIX A - COMMON APPLICATIONS FOR REFRACTORY CERAMIC FIBRES AND HIGH BIOPERSISTENCE FIBRES

Industry Application	Steel	Ceramics	Petrochem	Foundry	Non-ferrous	Power generation	Automotive	Glass	Other
Furnace linings	✓	✓	✓	✓	✓				✓
Back up insulation	✓	✓	✓	✓	✓	✓		✓	✓
Ingot mould linings	✓			✓	✓				
Ladle covers	✓			✓	✓				
Molten metal transport & distribution				✓	✓				✓
Expansion joints & seals	✓	✓	✓	✓	✓	✓		✓	✓
Burner ports or tubes	✓	✓	✓	✓	✓				
Turbine insulation						✓			
Heat curtains	✓			✓	✓			✓	✓
Weld stress relief	✓		✓						
Pipe & duct insulation			✓			✓			
Fire protection			✓			✓			✓
High temp. filtration				✓					
Catalytic convertors							✓		
Heat shields							✓		✓
Slow cooling blankets	✓			✓					

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THIS GUIDE PROVIDES PRACTICAL GUIDANCE
ON HOW TO MANAGE HEALTH AND
SAFETY RISKS ASSOCIATED WITH USING
AND REMOVING MATERIALS CONTAINING
REFRACTORY CERAMIC FIBRES (RCF) AND
OTHER HIGH BIOPERSISTENCE FIBRES (HBF).

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