SYNTHETIC VITREOUS FIBRES

Guidelines for Construction
## SYNTHETIC VITREOUS FIBRES

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This data sheet has been reviewed and endorsed by Ontario construction’s network of labour-management health and safety committees and is fully a document of accord between labour and management authorities.

In the past, members of the public have used printed information that was outdated by subsequent improvements in knowledge and technology. We therefore make the following statement for their protection in future.

The information presented here is, to the best of our knowledge, current at time of printing and is intended for general application. This publication is not a definitive guide to government regulations or to practices and procedures wholly applicable under every circumstance. The appropriate regulations and statutes should be consulted. Although the Construction Safety Association of Ontario cannot guarantee the accuracy of, nor assume liability for, the information presented here, we are pleased to answer individual requests for counselling and advice.

Acknowledgement

This data sheet was developed by the Occupational Disease and Research Labour-Management Health and Safety Committee in consultation with the following groups:

- Ontario Ministry of Labour
- North American Insulation Manufacturers Association
- Refractory Ceramic Fiber Coalition
- Ontario construction’s labour-management network.

The Construction Safety Association appreciates the expertise and cooperation of all these groups in producing and reviewing this data sheet.

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SYNTHETIC VITREOUS FIBRES

Introduction
Synthetic vitreous fibres (SVF)—also known as man-made mineral fibres (MMMF), synthetic mineral fibres (SMF), and man-made vitreous fibres (MMVF)—have been used extensively in the construction industry as insulating and fire protection material.

This data sheet summarizes the potential risks associated with SVF and recommends precautions for protecting those who work with SVF. Part One deals with glass wool (also known as fibre glass) and mineral wool (also known as rock and slag wool). Part Two deals with refractory ceramic fibres (RCF). The guidance given here is considered good practice and can help employers and supervisors meet the general duty requirement to provide a safe working environment under Ontario’s Occupational Health and Safety Act. This data sheet does not address new biosoluble high-temperature non-RCF products.

Because of the different conditions and products found on construction sites, the measures provided here may not be applicable in all situations. Any questions or inquiries should be directed to the Construction Safety Association of Ontario (CSAO) or the Ontario Ministry of Labour.

Types and Uses of SVF
SVF has been commercially manufactured and marketed for the last 60 years. In construction, the main types are mineral wool, glass wool, and RCF (see chart below). Mineral wool can be further subdivided into rock wool and slag wool.

Glass and mineral wools are used in a range of thermal and sound insulation applications in homes and commercial buildings. RCF and high-temperature non-RCF are used mainly for specialized applications involving very high temperatures. The table below outlines the main uses of SVF in the construction industry.
### Main Types of SVF

<table>
<thead>
<tr>
<th>Description</th>
<th>Uses</th>
<th>Common Application</th>
</tr>
</thead>
</table>
| **Glass wool or fibre glass** | Thermal and sound insulation in residential, commercial and industrial situations. It is also used in many construction products. | • Insulation batts  
• Duct insulation  
• Preformed pipe insulation  
• Board products and exterior insulation finishing system (EIFS)  
• Loose fill or blown-in insulation  
• Sprayed-on insulation |
| **Slag wool** | Thermal, acoustic, and fire protection | • Ceiling tiles, ceiling, wall, or duct insulation  
• Preformed pipe sections over steam pipes or boilers  
• Sprayed fire protection  
• Board insulation  
• Loose fill |
| **Rock wool** | Thermal, acoustic, and fire protection | • Ceiling tiles, ceiling, wall, or duct insulation  
• Preformed pipe sections over steam pipes or boilers  
• Sprayed fire protection  
• Board insulation  
• Loose fill |
| **Refractory ceramic fibre (RCF)** | High-temperature insulation for • power stations  
• furnace linings  
• gas turbines  
• kilns | • Blankets  
• Modules  
• Boards  
• Bulk  
• Paper/felt |
| **Biosoluble high-temperature alternative to RCF*** | High-temperature insulation for • power stations  
• furnace linings  
• gas turbines  
• kilns  
• fire protection | • Blankets  
• Modules  
• Boards  
• Bulk  
• Paper/felt |

*Although this data sheet does not address the new biosoluble high-temperature alternatives to RCF products, many of the controls outlined for mineral and glass wools (Part One) represent good hygiene practices and can be applied to these alternatives. Special care is needed when removing all vitreous (glassy) fibres that have endured prolonged heating at temperatures above 900°C because they may contain crystalline silica as cristobalite (see section on removing RCF in Part Two).*
PART ONE
Glass and Mineral Wool

Are glass and mineral wool a concern?
Handling, cutting, blowing or sawing glass wool and mineral wool without dust control can release fibres into the air. Short-term health effects include sneezing, coughing, and temporary irritation of skin, eyes, and nose. Higher exposure may cause difficulty breathing, congestion, and chest tightness.

Short-Term Effects
Workers handling glass and mineral wool can experience temporary irritation of the skin, eyes, nose, and throat. The most common effect is temporary skin irritation caused by fibres penetrating the skin’s outer layers.

Long-Term Effects
To date there has been no consistent epidemiological evidence that workers exposed to glass wool or mineral wool are at an increased risk of developing any chronic respiratory disease.

Carcinogenic Classification
With regard to their carcinogenicity, insulation wools have been evaluated by two independent organizations:
• International Agency for Research on Cancer (IARC) – an agency of the World Health Organization
• American Conference of Governmental Industrial Hygienists (ACGIH) – an independent professional organization.

Evaluation by International Agency for Research on Cancer (IARC)
Glass wool, rock wool, and slag wool are considered not classifiable as to carcinogenicity to humans (Group 3) by the International Agency for Research on Cancer (IARC). IARC found
1) no evidence of increased risks of lung cancer or mesothelioma from occupational exposures during the manufacture of mineral fibres
2) inadequate evidence overall of any cancer risk.

Classification by the ACGIH
Glass wool, rock wool, and slag wool have been classified by ACGIH as a confirmed animal carcinogen with unknown relevance to humans (A3).

See Appendix A for a description of these carcinogenic classifications.

<table>
<thead>
<tr>
<th></th>
<th>IARC</th>
<th>ACGIH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glass wool</td>
<td>Not classifiable as to carcinogenicity to humans</td>
<td>Animal carcinogen with unknown relevance to humans</td>
</tr>
<tr>
<td>Rock/Slag Wool</td>
<td>Not classifiable as to carcinogenicity to humans</td>
<td>Animal carcinogen with unknown relevance to humans</td>
</tr>
</tbody>
</table>

Summary of glass and mineral fibre carcinogenic classification
General Duties and Responsibilities – Glass and Mineral Wool Operations

Manufacturers
For their suppliers and users, manufacturers should prepare and distribute labels and material safety data sheets (MSDSs) that meet Workplace Hazardous Materials Information System (WHMIS) requirements.

Manufacturers of glass and mineral wool have a Product Stewardship Program (PSP) in place to help customers evaluate, control, and reduce workplace exposures to glass and mineral wool. Program recommendations are intended to help ensure the proper handling, manufacture, storage, use, and disposal of glass and mineral wool products.

North American Insulation Manufacturers Association (NAIMA)
NAIMA members manufacture fibreglass, slag wool, and rock wool insulation products. One of NAIMA’s roles is to promote the safe use of these materials.

In May 1999, NAIMA began implementing a comprehensive voluntary work practice partnership with the U.S. Occupational Safety and Health Administration (OSHA). The initiative, known as the Health and Safety Partnership Program, promotes the safe handling and use of insulation materials and incorporates education and training on the manufacture, fabrication, installation, and removal of fibreglass, rock wool, and slag wool insulation products.

For more information, contact
NAIMA
Phone: (703) 684-0084, Fax: (703) 684-0427
E-mail: insulation@naima.org
Website: www.naima.org

Suppliers
Suppliers should
• ensure that MSDSs are transmitted to their customers and that glass and mineral wool products are properly labelled
• pass on to their users any health and safety instructions or guidance given to them by the manufacturer.

Employers
Employers must
• comply with the Occupational Health and Safety Act by ensuring that all workers and supervisors receive adequate instruction and training on the safeguards necessary when exposed, or potentially exposed, to glass and mineral wool
• select for use products or work practices that minimize the generation of fibres wherever possible (for example, use preformed products that require minimal cutting and handling or that are fully encapsulated)
• provide the necessary personal protective equipment and offer washing facilities with clean water, soap, and individual towels for workers exposed to glass and mineral wool
• ensure that appropriate housekeeping, removal, and disposal procedures are in place to minimize the generation of fibres and dust
• follow manufacturers’ instructions that exceed the requirements outlined in this data sheet.
Contractors
The general contractor is obligated to inform other trades of the potential hazards of all controlled products present at the construction site, including, where applicable, those associated with glass and mineral wool.

Workers
Workers must
• carry out their work with insulation wools in accordance with the instructions and training they have received
• wear the personal protective equipment (PPE) provided by the employer.


Dust and Fibre Control
Exposure to dust and fibre can be minimized by
• keeping the material in its packaging as long as practical
• lightly misting glass and mineral wool with water during product removal and disposal.

Work Practices
In order to minimize the number of workers exposed to glass and mineral wool, take the following precautions.
• Insulating materials must not be permitted to fall freely from one level to another during removal operations.
• If cutting or trimming is required, use hand tools or power tools equipped with effective dust collection systems whenever possible. Power tools without effective dust collection systems generate significantly more airborne dust.
• Do not use compressed air to clean up or blow dust off clothing. This practice increases fibres in the air.

Personal Protective Equipment
Employers should ensure that workers required to wear personal protective equipment (PPE) are fully informed of the requirements and the reasons for doing so and are given adequate training in selecting, wearing, maintaining, and storing the equipment.

Respiratory Protection
Respiratory protection is usually recommended only when other control methods such as substitution, isolation, enclosure, work practices, ventilation, and wetting do not eliminate or sufficiently reduce the exposure.

Respiratory protective equipment should be carefully chosen to ensure that it offers adequate protection. The right style of respirator to wear is an air-purifying respirator. As the name indicates, these devices purify the air drawn through them. They filter out dust and fibres but do not supply fresh air.

Based on fibre levels and respiratory irritation, the Construction Safety Association of Ontario (CSAO) has made recommendations on the type of respirator and class of filters to be used (page 11). CSAO’s Construction Health and Safety Manual (M029) provides further guidance on respirators and filters.
Respiratory protective equipment must be approved by the National Institute of Occupational Safety and Health (NIOSH). Paper masks or surgical masks without a NIOSH approval number must NOT be used because they do little to protect the worker.

Workers must be fit-tested to ensure that any tight-fitting respirator makes a proper seal with the face. Fit-testing and training must be done by a competent person familiar with respirator selection, care, and use.

Facial hair, even stubble, will allow some dust to bypass the respirator and be inhaled. Therefore workers wearing respirators that require a facial seal must be clean-shaven where the facepiece contacts the skin.

Canadian Standards Association (CSA) standard CSA Z94.4-02 Selection, Care and Use of Respirators provides further guidance on the basic elements of a respiratory protection program.

Eye Protection

Appropriate eye protection, such as dust-resistant safety goggles or safety glasses with side shields, should be worn in dusty environments. Because of the risk of eye irritation, contact lenses are not recommended for work around fibres unless the eyes are suitably protected.

Protective Clothing

Protective clothing requirements will vary according to the specific operation (see page 10). The following precautions are generally recommended for mineral wool and glass wool.

- Wear loose-fitting, full-body clothing. Tight cuffs or collars should be avoided as they can cause irritation by rubbing fibres into the skin.
- Wear cotton gloves to prevent skin contact.
- Before leaving the workplace, remove protective clothing contaminated with mineral wool to reduce the risk of contaminating vehicles and exposing your family to the hazard.
- Wash clothing that has been worn while handling or using mineral wool separately from other household laundry. This will prevent fibres from being transferred to other clothes.
- Never use compressed air to remove fibres adhering to clothes. Use a high efficiency particulate aerosol (HEPA) vacuum instead. Compressed air can be delivered at pressures up to 1050 kPa (150 psi)—sufficient to blow fibres and particles into your eyes or abrade your skin. Though rare, it is also possible for compressed air to enter broken skin and create an air bubble in the bloodstream. This condition, known as an embolism, can cause coma, paralysis, or death.

The use of protective clothing can aggravate heat stress, especially in summer. Therefore choose clothing that minimizes heat stress and discomfort. Refer to CSAO’s data sheet Heat Stress: Guidelines for Recognition, Assessment, and Control in Construction (DS034).

Housekeeping and Cleaning

- Scrap glass and mineral wool and visible dust should be removed at the end of each shift or at the end of each operation by wet sweeping.
- Leaf blowers, compressed air, or dry sweeping should not be used for clean-up; these methods only blow the fibres back into the air and deposit them elsewhere.
- Waste materials should be placed in covered, sealed waste disposal containers to avoid dust generation.
• Waste glass and mineral wool must be disposed of in accordance with Ministry of Environment regulations.

Hygiene
• Workers experiencing skin irritation from glass wool or mineral wool should first rinse their skin with warm water and then gently wash with soap.
• Eating, smoking, or drinking in areas where there is risk of contamination by glass and mineral wool should be prohibited. Breaks for food and drinks should be taken in a separate, designated ‘clean’ area. Coveralls and gloves should be removed and hands washed before eating.

Specific Measures of Prevention and Protection – Glass and Mineral Wool Operations

On behalf of Ontario construction, CSAO has conducted exposure monitoring, reviewed scientific literature, and consulted with NAIMA to determine potential exposure levels for a given task and the need for respiratory protection. Appendix B shows fibre levels that can be encountered during various operations.

Workers’ exposure during glass and mineral wool operations can vary greatly from day to day within a workplace and from workplace to workplace due to differences in work practices and environmental conditions. Procedures are therefore needed for specific glass and mineral wool operations in order to ensure that workers are not overexposed.

Exposure monitoring by the employer should not be necessary when the general and specific preventive measures set out in this data sheet are followed. If employers choose not to follow these measures, they may need to perform air sampling in order to determine possible exposure levels. Unless approximate fibre concentrations during various operations are known, it will not be possible to determine what respiratory precautions are necessary.

In addition to the specific procedures outlined below, the procedures under "General Measures of Prevention and Protection – Glass and Mineral Wool Operations" should be followed.

**Nozzle Type**

In 1993 CSAO studied the relationship between different nozzle types and the amount of fibres and dust generated. This research showed that two types of nozzles (combination air/water and multi water-point) were more effective than the conventional single water-point in reducing dust and fibre levels. CSAO therefore recommends that combined air/water or multi water-point nozzles be used whenever possible.

**Fireproofing Spray Application**

• Spraying machines should be properly maintained and set to deliver the correct proportions of spray insulation materials and water.
• It is recommended that the operator of the spraying machine wear a NIOSH-approved N95 air-purifying respirator, dust-resistant safety goggles, and disposable coveralls with hood.
• It is recommended that the worker loading the hopper wear a NIOSH-approved N95 air-purifying respirator and dust-resistant safety goggles.
• Caution tape and warning signs restricting access to the spray area should be posted before the start of spraying. The signs should convey the following warning:
Workers not involved in the spraying operation should not be allowed in the restricted area.

For new construction, fastening devices such as hangers should be completely installed before spraying begins. Ductwork, piping, and other obstructions should not be installed before spraying.

During renovations, openings such as ventilation duct openings that could permit the spread of fireproofing materials should be temporarily sealed before spraying starts.

Construction equipment and materials in the spray area should be removed before spraying or be covered with plastic.

If the spray area is not enclosed by walls, plastic sheeting should be used to prevent the spread of dust and fibres.

Once spraying is completed, all fireproofing that has fallen on the floor and any overspray material should be cleaned up by wet sweeping or HEPA vacuuming.

**Trades Working around Sprayed Fireproofing**

If other trades are required to disturb or remove fireproofing in order to weld, perform cutouts, run wires, or make attachments, the following precautions should be taken.

- Carefully and thoroughly mist the fireproofing with water before removing it.
- Position a collection bag under the area being scraped to collect falling material.
- Immediately clean up any material falling to the floor.
- Wear safety glasses with side shields.
- If a worker prefers to use a respirator when one is not required, a NIOSH-approved N95 air-purifying respirator should be provided and worn.

**Caution:** Electricians, sprinkler-fitters, sheetmetal workers, and other trades may be exposed to glass and mineral wool fibres when they unintentionally disturb material during overhead work. For instance, impact drills can generate vibration which may cause fireproofing material to vibrate loose. Precautions should be taken before such work, and cleanup measures taken afterwards, to minimize exposures.

**Batt and Blanket Insulation**

- Tearing the product by hand should be avoided because this generates airborne fibres. Batt insulation should be cut with a sharp knife.
- For batt insulation, a NIOSH-approved N95 air-purifying respirator and dust-resistant safety goggles are recommended.

**Blown Insulation in Attics**

- In general, blown glass fibre products without binder are likely to generate higher dust concentrations than products with binder.
- Installers blowing insulation into the attic should wear a NIOSH-approved N95 air-purifying respirator, dust-resistant safety goggles, and disposable coveralls.
- It is recommended that feed operators use a NIOSH-approved N95 air-purifying respirator, dust-resistant safety goggles, and disposable coveralls.
- Remember – the smaller the attic space the higher the risk of exposure.
- During residential applications (especially renovations), prevent fibres from entering the living space by using a plastic dropsheet under the access hatch. Additionally, any openings in the ceiling that would allow insulation to fall through into the living space should be covered.
- After installation, the area under the access hatch should be cleaned.
Pipe, Duct, and Boiler Insulation

- It is recommended that pipe insulators use a NIOSH-approved N95 air-purifying respirator and dust-resistant safety goggles.
- If pipe jacketing is to be installed, it should be applied as soon after the insulation as possible in order to minimize unnecessary abrasion and fibre release.
- When a newly insulated boiler is first started up, the binders used in the manufacturing of glass and mineral wool can decompose when the boiler temperature rises above 175°C. This "off-gassing" may occur over the first 3 to 4 days of operation, depending on boiler temperature.
  o The vapour, smoke, and gases given off as the binder decomposes at start-up should be vented to the outside.
  o Workers not directly involved in the application should be kept out of the work area or allowed in only as briefly as possible.
  o If the area cannot be vented, workers should wear a respirator appropriate for the decomposition products, which should be listed in the material safety data sheet for the insulation wool.
- Although very rare at boiler start-up, there is a potential for flash fire due to excessive oil in the new insulation. Fire-extinguishing equipment should therefore be available.

Insulation Ceiling Tiles

- Ceiling tiles should be cut and trimmed with a razor knife or keyhole saw.
- Tile scraps should not be allowed to accumulate. Clean up as often as necessary to keep the area clear.
- It is recommended that workers installing ceiling tiles use a NIOSH-approved N95 air-purifying respirator and safety glasses with side shields.

Removal, Maintenance, and Demolition

The potential for generating fibres and dust during removal, maintenance, and demolition involving glass and mineral wool can be significant.

- Where practicable, the insulation should be lightly misted with water before and during removal.
- The work area should be isolated by safety tape and warning signs.
- In most situations, a NIOSH-approved N95 air-purifying respirator, dust-resistant safety goggles, and disposable coveralls will provide adequate protection. However, if the activity generates substantial amounts of dust, a more protective respirator may be necessary. For example, major demolition may require a full-facepiece respirator or a supplied-air respirator instead of a half-facepiece air-purifying respirator.
- All waste material should be placed in covered, sealed waste disposal containers as it is removed. If the material is wet, it should be placed in waterproof containers.
- Material to be removed should be handled carefully and not thrown about. Rough handling will release dust and fibres into the air.
- Before maintenance or removal, ventilation duct openings and other openings that could permit the spread of fibres should be temporarily sealed.
- Work areas should be kept clean and scrap material removed as often as necessary to keep the area clean.
# Glass Fibre and Mineral Wool
## Summary of PPE Requirements

<table>
<thead>
<tr>
<th>Type of work</th>
<th>Recommended respirator type</th>
<th>Protective clothing</th>
<th>Gloves</th>
<th>Eye protection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fireproofing spray application</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sprayer</td>
<td>N95 air-purifying respirator</td>
<td>Disposable coveralls</td>
<td>Cotton</td>
<td>Dust-resistant safety goggles</td>
</tr>
<tr>
<td>Feeder</td>
<td>N95 air-purifying respirator</td>
<td>Disposable coveralls</td>
<td>Cotton</td>
<td>Dust-resistant safety goggles</td>
</tr>
<tr>
<td><strong>Trades working around or disturbing sprayed fireproofing material</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drywaller/bricklayer/ sheetmetal worker/ electrician/pipefitter</td>
<td>N95 air-purifying respirator optional</td>
<td>Loose-fitting full-body clothing</td>
<td>Optional</td>
<td>Safety glasses with side shields</td>
</tr>
<tr>
<td><strong>Blown insulation in attics</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Installer</td>
<td>N95 air-purifying respirator</td>
<td>Disposable coveralls</td>
<td>Cotton</td>
<td>Dust-resistant safety goggles</td>
</tr>
<tr>
<td>Feeder</td>
<td>N95 air-purifying respirator</td>
<td>Disposable coveralls</td>
<td>Cotton</td>
<td>Dust-resistant safety goggles</td>
</tr>
<tr>
<td><strong>Pipe, duct, and boiler Insulation</strong></td>
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<td></td>
<td></td>
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<tr>
<td>Insulating pipes</td>
<td>N95 air-purifying respirator</td>
<td>Loose-fitting full-body clothing</td>
<td>Cotton</td>
<td>Safety glasses with side shields</td>
</tr>
<tr>
<td><strong>Insulation wool ceiling tiles</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Installing ceiling tiles</td>
<td>N95 air-purifying respirator</td>
<td>Loose-fitting full-body clothing</td>
<td>Cotton</td>
<td>Safety glasses with side shields</td>
</tr>
<tr>
<td><strong>Removal, maintenance, and demolition</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Removal and storage of batt insulation</td>
<td>N95 air-purifying respirator</td>
<td>Disposable coveralls</td>
<td>Cotton</td>
<td>Safety glasses with side shields</td>
</tr>
<tr>
<td>Removal, storage, and clean-up of ceiling tiles</td>
<td>N95 air-purifying respirator</td>
<td>Disposable coveralls</td>
<td>Cotton</td>
<td>Safety glasses with side shields</td>
</tr>
<tr>
<td>Demolition</td>
<td>N95 air-purifying respirator</td>
<td>Disposable coveralls</td>
<td>Cotton</td>
<td>Dust-resistant safety goggles</td>
</tr>
</tbody>
</table>
PART TWO
Refractory Ceramic Fibres (RCF)

Is RCF a concern?
Handling, cutting, or sawing RCF without dust control can release significant amounts of fibre. Short-term health effects include coughing, sneezing, and temporary irritation of skin, eyes, and nose. Higher exposure may cause difficulty breathing, congestion, and chest tightness. Results of long-term inhalation tests with animals show that RCF can cause respiratory diseases when administered at very high doses. This has not been confirmed in humans.

Short-Term Effects
Workers handling RCF can experience temporary irritation of the skin, eyes, nose, and throat. The most common effect is skin irritation caused by fibres penetrating the skin’s outer layers.

Long-Term Effects
Experiments in animals have shown that RCF can produce lung cancer, mesothelioma, and lung fibrosis following long-term inhalation of very high concentrations. But there has been no consistent evidence to date that workers exposed to RCF are at an increased risk of developing lung fibrosis, lung cancer, or mesothelioma. An increased prevalence of pleural plaques in RCF-manufacturing workers has been noted.

Carcinogenic Classification
With regard to their carcinogenicity, RCF products have been evaluated by two independent organizations:
• International Agency for Research on Cancer (IARC)—an agency of the World Health Organization
• American Conference of Governmental Industrial Hygienists (ACGIH)—an independent professional organization.

Evaluation by International Agency for Research on Cancer (IARC)
Refractory ceramic fibres are regarded as more biopersistent than glass and mineral wool, and are classified by IARC as being a possible human carcinogen (Group 2B).

Classification by the ACGIH
Refractory ceramic fibres have been classified by ACGIH as a suspected human carcinogen (A2).

See Appendix A for a description of these carcinogenic classifications.

Summary of RCF Carcinogenic Classification

<table>
<thead>
<tr>
<th></th>
<th>IARC</th>
<th>ACGIH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refractory Ceramic Fibres</td>
<td>Possibly carcinogenic to humans</td>
<td>Suspected human carcinogen</td>
</tr>
</tbody>
</table>

Biosolubility
The terms biosolubility, biopersistence and durability all concern how long the fibres will last in the lungs before the body’s natural defences remove them. The more biopersistent or durable the fibres are, the longer
they last in the lungs and the greater their potential for causing cancer and other respiratory diseases. The more biosoluble a fibre, the faster it is broken down by the body with lower risk of associated diseases.

Great effort and research has gone into developing newer insulation materials which have insulation properties similar to current RCF products but which disappear from body tissues more rapidly. This research governs the way MMMFs are regulated in the European Union—that is, the more biopersistent or durable a RCF is, the more likely it is to be classified as a carcinogen.

Insulation manufacturers are developing and marketing new biosoluble high-temperature non-RCF products. In addition to insulation requirements, architects/designers/engineers may therefore wish to consider biosolubility when specifying insulation products.

To date, the ACGIH has not performed a hazard evaluation of the new biosoluble high temperature non-RCF products and no specific exposure limit exists for them. However, in Ontario an exposure limit of 1 f/cc has been set for SVF not otherwise classified.

Although this data sheet does not address high-temperature non-RCF products, many of the controls outlined for mineral and glass wools represent good hygiene practices that can be applied to the new biosoluble non-RCF products.

**General Duties and Responsibilities – RCF Operations**

**Manufacturers of RCF**

For their suppliers and users, manufacturers should prepare and distribute labels and material safety data sheets (MSDSs) that meet Workplace Hazardous Materials Information System (WHMIS) requirements.

Manufacturers of RCF have a Product Stewardship Program (PSP) in place to help customers evaluate, control, and reduce workplace exposures to RCF. Program recommendations are intended to help ensure the proper handling, manufacture, storage, use, and disposal of RCF products.

**Refractory Ceramic Fibers Coalition**

RCFC is an association of the leading producers of RCF. These producers are Thermal Ceramics, Vesuvius USA, and Unifrax Corporation. Through its voluntary worker protection program, RCFC develops and promotes proper work practices and standards for the industry, conducts health research, and disseminates information on the proper handling and use of RCF.

For more information, contact

Thermal Ceramics 1-800-722-5681 www.ThermalCeramics.com
Unifrax Corporation 1-800-322-2293 www.Unifrax.com
Vesuvius 1-800-355-1100 www.Vesuvius.com

Email: rcfc@buffnet.net
Website: www.rcfc.net

**Suppliers**

Suppliers should

- ensure that MSDSs are transmitted to their customers and that RCF products are properly labelled
- pass on to their users any health and safety instructions or guidance given to them by the manufacturer.
Employers
Employers must
• comply with the Occupational Health and Safety Act by ensuring that all workers and supervisors receive adequate instruction and training on the safeguards necessary when exposed, or potentially exposed, to RCF
• select for use products or work practices that minimize the generation of fibres wherever possible (for example, use preformed products that require minimal cutting and handling, are fully encapsulated, and are the right size)
• recognize when airborne RCF may be generated and—in consultation with the joint health and safety committee or worker representative (where applicable)—develop a plan to eliminate or control worker exposure
• provide the necessary personal protective equipment (PPE) and offer wash-up facilities with clean water, soap, and individual towels for workers exposed to RCF
• ensure that appropriate housekeeping, removal, and disposal procedures are in place to minimize the generation of fibres and dust.

Contractors
The general contractor is obligated to inform other trades of the potential hazards of all controlled products present at the construction site, including those associated with RCF operations.

Workers
Workers must
• carry out their work with insulation wools in accordance with the instructions and training they have received
• wear the personal protective equipment (PPE) provided by the employer.

General Measures of Prevention and Protection – RCF Operations

Dust and Fibre Control
Exposure to dust and fibre can be minimized by
• keeping the material in its packaging as long as practical
• lightly misting RCF with water during product removal and disposal.

Work Practices
In order to minimize the number of workers exposed to RCF, take the following precautions.
• Insulating materials must not be permitted to fall freely from one level to another during removal operations.
• If cutting or trimming is required, use hand tools or power tools equipped with effective dust collection systems whenever possible. Power tools without effective dust collection systems generate significantly more airborne dust.
• Do not use compressed air to clean up or blow dust off clothing. This practice increases fibres in the air.

Personal Protective Equipment
Employers should ensure that workers required to wear personal protective equipment are fully informed of the requirements and the reasons for doing so and are given adequate training in selecting, wearing, maintaining, and storing the equipment.
Respiratory Protection
Respiratory protection is usually recommended only when other control methods such as substitution, isolation, enclosure, work practices, ventilation, and wetting do not eliminate or sufficiently reduce the exposure.

Respiratory protective equipment should be carefully chosen to ensure that it offers adequate protection. The right style of respirator to wear is an air-purifying respirator. As the name indicates, these devices purify the air drawn through them. They filter out dust and fibres but do not supply fresh air.

Based on fibre levels and respiratory irritation, CSAO has made recommendations on the type of respirator and class of filters to be used (see page 18). CSAO’s Construction Health and Safety Manual (M029) provides further guidance on respirators and filters.

Please note that these are recommendations only. The type of respiratory protection required will vary depending on the dust levels generated during different applications.

- Respiratory protective equipment must be approved by the National Institute of Occupational Safety and Health (NIOSH). Paper masks or surgical masks without a NIOSH approval number must NOT be used because they do little to protect the worker.
- Workers must be fit-tested to ensure that any tight-fitting respirator makes a proper seal with the face.
- Fit-testing and training must be done by a competent person familiar with respirator selection, care, and use.
- Facial hair, even stubble, will allow some dust to bypass the respirator and be inhaled. Therefore workers wearing respirators that require a facial seal must be clean-shaven where the facepiece contacts the skin.
- Canadian Standards Association (CSA) standard CSA Z94.4-02 Selection, Care and Use of Respirators provides further guidance on the basic elements of a respiratory protection program.

Eye Protection
Appropriate eye protection such as dust-resistant safety goggles or safety glasses with side shields should be worn in dusty environments. Because of the risk of eye irritation, contact lenses are not recommended for work around fibres unless the eyes are suitably protected.

Protective Clothing
Protective clothing requirements will vary according to the specific operation (see page 17). The following precautions are generally recommended.
- When working with RCF the use of one-piece disposable coveralls with hood is recommended. The coveralls should not be reused and should be disposed of at the end of each shift. Be careful to minimize exposure to any dust or fibres adhering to overalls when they are being taken off.
- Under certain circumstances, such as a fire hazard, the use of disposable coveralls may not be allowed. In such cases, a policy governing protective clothing should be developed in conjunction with the joint health and safety committee or worker representative, if there is one, and should include written instructions on cleaning, removing and washing protective clothing.
- In order to protect family members from exposure, clothing contaminated with RCF should not be taken home.

The use of protective clothing can aggravate a worker’s heat stress, especially in summer. Therefore choose clothing that minimizes heat stress and discomfort. Refer to CSAO’s data sheet Heat Stress: Guidelines for Recognition, Assessment, and Control in Construction (DS034).
Housekeeping and Cleaning

- Scrap material and visible dust should be removed at the end of each shift or at the end of each operation by wet sweeping or with a HEPA vacuum.
- Care should be taken to ensure that dust is not released when changing the HEPA filter (refer to manufacturer’s instructions on how to maintain and change HEPA filters).
- Leaf blowers, compressed air, or dry sweeping should not be used for clean-up; these methods only blow the fibres back into the air and deposit them elsewhere.
- Waste fibre should be carefully placed directly into heavy-duty plastic bags and sealed.
- Waste RCF must be disposed of in accordance with Ministry of Environment regulations.

Hygiene

- Because of the potential for skin irritation from RCF, facilities should be provided to enable workers to wash up when necessary. The skin should first be rinsed with warm water and then gently washed with soap.
- Eating, smoking, or drinking in areas where there is risk of contamination by RCF should be prohibited. Breaks for food and drinks should be taken in a separate, designated "clean" area. Coveralls and gloves should be removed and hands washed before eating.

Specific Measures of Prevention and Protection – RCF Operations

On behalf of Ontario construction, CSAO has conducted exposure monitoring, reviewed scientific literature, and consulted with the RCFC to determine potential exposure levels for a given task and the need for respiratory protection. Appendix B shows fibre levels that can be encountered during various operations.

Workers’ exposure during RCF operations can vary greatly from day to day within a workplace and from workplace to workplace due to differences in work practices and environmental conditions. Procedures are therefore needed for specific RCF operations in order to ensure that workers are not overexposed.

Exposure monitoring by the employer should not be necessary when the general and specific preventive measures set out in this data sheet are followed. If employers choose not to follow these measures, they may need to perform air sampling in order to determine possible exposure levels. Unless approximate fibre concentrations during various operations are known, it will not be possible to determine what respiratory precautions are necessary.

In addition to the specific procedures outlined below, the procedures under “General Measures of Prevention and Protection – RCF Operations” should be followed.

Installation of RCF block, boards, modules, and blankets

- Avoid having to cut RCF materials by purchasing preformed shapes.
- Cut RCF blocks, blankets, boards, and modules in a well-ventilated area.
- Use local exhaust ventilation equipped with HEPA filters at points where RCF dust will be generated.
- It is recommended that workers cutting and installing RCF block, board, modules, or blankets use a NIOSH-approved N100 air-purifying respirator, dust-resistant safety goggles, and disposable coveralls. If local exhaust ventilation is used as recommended, then an N95 air-purifying respirator may be appropriate.
Installing Fully Encapsulated RCF Duct Wrap

Fully encapsulated duct wrap is composed of a blanket of RCF encapsulated with aluminum–reinforced foil wrap.

- Avoid having to cut RCF materials by purchasing preformed shapes.
- Cut RCF encapsulated blankets in a well-ventilated area with a sharp knife.
- Use local exhaust ventilation equipped with a HEPA filter at points where cutting will generate RCF dust.
- Carefully tape the cut edges. It may be necessary to punch a hole in the duct wrap after taping the edge to release the air pressure. This should be done carefully so as not to release fibres into the air. The holes should be taped once air pressure is released.
- When installing encapsulated duct wrap, avoid excessive pounding of the material.
- It is recommended that workers cutting and installing RCF encapsulated blanket use a NIOSH-approved N95 air-purifying respirator, dust-resistant safety goggles, and disposable coveralls.

Installing Un-encapsulated RCF Duct Wrap

- Avoid having to cut RCF materials by purchasing preformed shapes.
- Cut RCF un-encapsulated blankets in a well-ventilated area with a sharp knife.
- Use local exhaust ventilation equipped with a HEPA filter at points where cutting will generate RCF dust.
- When installing the un-encapsulated duct wrap avoid excessive pounding of the material.
- It is recommended that workers cutting and installing RCF un-encapsulated blankets use a NIOSH-approved N100 air-purifying respirator, dust-resistant safety goggles, and disposable coveralls.

Spraying or Gunning RCF

Spraying or gunning RCF creates extremely high levels of dust and fibres. This practice is **NOT** recommended.

Airborne exposure to RCF can be controlled by wet-installation techniques that use
- RCF containing caulk
- RCF containing trowelable cements
- RCF contained within a foam or wet matrix.

Removing RCF

Removing RCF can generate high concentrations of fibres in the air.

- Except for the type of respirator, the general requirements for RCF removal and maintenance apply.
- Because of the potential for high levels of fibres during "rip-outs" in enclosed or semi-enclosed areas, it is recommended that the enclosure be mechanically vented, with extracted air HEPA-filtered to the inside or efficiently filtered to the outside.
- It is recommended that disposable coveralls and an N100 full-facepiece respirator or a powered air-purifying respirator (PAPR) with HEPA filters be worn for RCF removal.

**Note**

Special care is needed when removing RCF that has endured prolonged heating at temperatures above 900ºC because it may contain crystalline silica as cristobalite. The same type of respirator used for protection against RCF will also protect against cristobalite.
Refactory Ceramic Fibres
Summary of PPE Requirements

<table>
<thead>
<tr>
<th>Type of work</th>
<th>Respirator type</th>
<th>Protective coveralls</th>
<th>Gloves</th>
<th>Eye protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installing RCF insulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutting and installing RCF blankets, block, board, or modules</td>
<td>N100 dual-cartridge half-mask respirator</td>
<td>Disposable coveralls</td>
<td>Cotton</td>
<td>Dust-resistant safety goggles</td>
</tr>
<tr>
<td>Gunning RCF</td>
<td>This work practice is NOT recommended.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutting and installing duct wrap</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutting and installing fully encapsulated duct wrap</td>
<td>N95 air-purifying respirator.</td>
<td>Disposable coveralls</td>
<td>Cotton</td>
<td>Safety glasses with side shields</td>
</tr>
<tr>
<td>Cutting and installing un-encapsulated duct wrap</td>
<td>N100 dual-cartridge half-mask respirator.</td>
<td>Disposable coveralls</td>
<td>Cotton</td>
<td>Safety glasses with side shields</td>
</tr>
<tr>
<td>Removing refractory insulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Removing refractory insulation</td>
<td>N100 full-facepiece respirator or a powered air-purifying respirator (PAPR) with HEPA filters</td>
<td>Disposable coveralls</td>
<td>Cotton</td>
<td></td>
</tr>
</tbody>
</table>

Conclusion

Adhering to the requirements and recommendations in this data sheet can help to protect everyone in construction who may be exposed to synthetic vitreous fibres.

The prevention and protection measures specified for glass wool, mineral wool, and refractory ceramic fibres provide labour and management with the tools to ensure a safe, healthy workplace.

By following this data sheet, workers can avoid or control hazardous exposures while employers meet their legal obligations under the Occupational Health and Safety Act.
**APPENDIX A**

**Carcinogenic Classifications**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung fibrosis</td>
<td>This is a build-up of scar tissue following prolonged or repeated damage to the lungs, thereby making breathing very difficult.</td>
</tr>
<tr>
<td></td>
<td>In extreme cases, the disease can result in severe breathlessness, fatigue, and enlargement of the heart. Although fibrosis is rarely fatal in itself, the severe form is associated with heart failure. Individuals less seriously affected may suffer varying degrees of breathlessness. Those with the mildest form may be unaware of the disease.</td>
</tr>
<tr>
<td>Lung cancer</td>
<td>Lung cancer occurs when abnormal cells in the lungs divide without control to form growths called tumours.</td>
</tr>
<tr>
<td>Mesothelioma</td>
<td>Mesothelioma is a rare form of cancer that is found in the thin lining (membrane) of the lung, chest, abdomen, and heart. Almost all cases are linked to asbestos exposure. The disease may not show up until many years after asbestos exposure and is always fatal.</td>
</tr>
<tr>
<td>Pleural plaques</td>
<td>Pleural plaques are scarred areas on the lining of the chest wall and have been viewed predominantly as a marker of asbestos exposure. Pleural plaques have been linked to mild decreases in pulmonary function but have not been associated with pulmonary impairment.</td>
</tr>
<tr>
<td>Suspected human carcinogen (ACGIH, A2)</td>
<td>Human data are accepted as adequate in quality but are conflicting or insufficient to classify the agent as a confirmed human carcinogen. OR the agent is carcinogenic in experimental animals at dose levels, by route(s) of administration, at site(s), of histological type(s), or by mechanism(s) considered relevant to worker exposure. The A2 is used primarily when there is limited evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in experimental animals with relevance to humans.</td>
</tr>
<tr>
<td>Confirmed animal carcinogen with unknown relevance to humans (ACGIH, A3)</td>
<td>The agent is carcinogenic in experimental animals at dose levels, by route(s) of administration, at site(s), of histological type(s), or by mechanism(s) that are not considered relevant to worker exposure. Available epidemiological studies do not confirm an increased risk of cancer in exposed humans. Available evidence suggests that the agent is not likely to</td>
</tr>
</tbody>
</table>
Possible human carcinogen (IARC, Group 2B)

This category is used for agents, mixtures, and exposure circumstances for which there is limited evidence of carcinogenicity in humans and less than sufficient evidence of carcinogenicity in experimental animals. It may also be used when there is inadequate evidence of carcinogenicity in humans but there is sufficient evidence of carcinogenicity in experimental animals. In some instances, an agent, mixture, or exposure circumstance for which there is inadequate evidence of carcinogenicity in humans but limited evidence of carcinogenicity in experimental animals, together with supporting evidence from other relevant data, may be placed in this group.

Not classifiable as to carcinogenicity to humans (Group 3)

This category is used most commonly for agents, mixtures, and exposure circumstances for which the evidence of carcinogenicity is inadequate in humans and inadequate or limited in experimental animals.
APPENDIX B
Air Sampling Data

In Ontario, there are no occupational exposure limits for SVF that apply to construction projects. However, the Regulation respecting Control of Exposure to Biological or Chemical Agents (Ontario Regulation 833/90), which applies to workplaces other than construction projects, can be used for guidance.

Regulation 833/90 sets exposure limits. The "Time-Weighted Average Exposure Value" (TWAEV) is the maximum average concentration of a substance to which a worker may be exposed for an eight-hour period or forty-hour week. The current TWAEV for glass wool, rock wool, and slag wool is 1 fibre/cubic centimetre (1 f/cc). Regulation 833/90 does not specify a TWAEV for RCF. RCF therefore falls into the category of "synthetic vitreous fibres not otherwise classified," for which the exposure limit is 1 f/cc. The American Conference of Governmental Industrial Hygienists (ACGIH) recommends an exposure limit value (TLV®) of 1 f/cc for glass wool, rock wool, and slag wool and 0.2 f/cc for RCF. The Refractory Ceramic Fibers Coalition (RCFC) recommends an exposure guideline of 0.5 f/cc for RCF.*

Notes for air sampling data on the following pages

1. The exposure results are reported as f/cc (fibres/cubic centimetre).

What is 1 f/cc?
- Picture a sugar cube
- Then picture a fibre within that sugar cube
- That’s 1 f/cc.
- Now think of a room full of sugar cubes with a fibre in each of them.
- Of course, some areas will have no fibres while other areas will have more than one fibre. It’s the average that is of concern.
- A 500 ft³ room with a concentration of 1 f/cc will contain over 14 million fibres.

2. Results are reported as "personal samples" except where stated as "area samples."
3. "Personal sample" refers to an air sample taken in the breathing zone of the worker.
4. "Area sample" refers to a sample taken in a fixed area of the workplace.
5. Sampling results are based on tasks and reflect exposures over the time the worker was actually engaged in SVF-related activity. Therefore exposures are presented as task length averages and not as 8-hour time weighted averages.

* Exposure limits are based on eight-hour work shifts. However, extended work shifts of 10 or 12 hours are not uncommon in construction. Extended work shifts increase the employee’s exposure time while decreasing the non-exposure time (time away from the workplace). The Regulation respecting Control of Exposure to Biological or Chemical Agents (Ontario Regulation 833/90) provides guidance on how workers’ exposure should be calculated for shifts greater than eight hours.
The tables below show fibre levels that can be encountered during various SVF activities.

**Air sampling data for glass wool and mineral wool workplace exposures**

*For sampling results below the limit of detection (BOD), BOD values were used for calculation purposes.*

<table>
<thead>
<tr>
<th>Functional Job Category</th>
<th>Specific Tasks</th>
<th>Job Function</th>
<th>Primary SVF Form</th>
<th>Number of Observations</th>
<th>Minimum (f/cc)</th>
<th>Maximum (f/cc)</th>
<th>Median (f/cc)</th>
<th>Geometric Mean (f/cc)</th>
<th>Arithmetic Mean (f/cc)</th>
<th>Arithmetic Standard Deviation</th>
<th>Data Source</th>
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<tbody>
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<td>Spraying</td>
<td></td>
<td>Sprayer</td>
<td>Mineral wool</td>
<td>22</td>
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<td>1.081</td>
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<td>0.539</td>
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<tr>
<td></td>
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<td>Helper/ Feeder</td>
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<td>Trade area</td>
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<td>0.018</td>
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</tr>
<tr>
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<td>0.069</td>
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<td>Area sample during batt installation</td>
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<td>0.231</td>
<td>0.016</td>
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</tr>
</tbody>
</table>
Air sampling data for glass wool and mineral wool workplace exposures

For sampling results below the limit of detection (BOD), BOD values were used for calculation purposes.

<table>
<thead>
<tr>
<th>Functional Job Category</th>
<th>Specific Tasks</th>
<th>Job Function</th>
<th>Primary SVF Form</th>
<th>Number of Observations</th>
<th>Minimum (f/cc)</th>
<th>Maximum (f/cc)</th>
<th>Median (f/cc)</th>
<th>Geometric Mean (f/cc)</th>
<th>Arithmetic Mean (f/cc)</th>
<th>Arithmetic Standard Deviation</th>
<th>Data Source</th>
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<tbody>
<tr>
<td>Installation</td>
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<td>0.820</td>
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<td>Mineral wool</td>
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<td>—</td>
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<td>Installing duct</td>
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<td>Mineral wool</td>
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<td>0.696</td>
<td>0.966</td>
<td>0.966</td>
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<td>Drilling and hand tools</td>
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<td>Installing electrical terminals</td>
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<td>Mineral wool</td>
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### Air sampling data for glass wool and mineral wool workplace exposures

*For sampling results below the limit of detection (BOD), BOD values were used for calculation purposes.*

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<tr>
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<th>Specific Tasks</th>
<th>Job Function</th>
<th>Primary SVF Form</th>
<th>Number of Observations</th>
<th>Minimum (f/cc)</th>
<th>Maximum (f/cc)</th>
<th>Median (f/cc)</th>
<th>Geometric Mean (f/cc)</th>
<th>Arithmetic Mean (f/cc)</th>
<th>Arithmetic Standard Deviation</th>
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### Air sampling data for RCF workplace exposures

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<th>Arithmetic Mean (f/cc)</th>
<th>Arithmetic Standard Deviation</th>
<th>Data Source</th>
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### Air sampling data for RCF workplace exposures

<table>
<thead>
<tr>
<th>Functional Job Category</th>
<th>Specific Tasks</th>
<th>Primary RCF Form</th>
<th>Number of Observations</th>
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<th>Arithmetic Standard Deviation</th>
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Data Source: Air sampling data for RCF workplace exposures
Air sampling data for RCF workplace exposures

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<th>Functional Job Category</th>
<th>Specific Tasks</th>
<th>Primary RCF Form</th>
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RCFC data set used: Combined U.S. and European workplace monitoring database through 2002, with a minimum of 10 observations per subset (except water lance removal).