61155 -1020

Thermal Ceramics

MATERIAL SAFETY DATA SHEET

MSDS No: 211	Date Prepared: 05/01/1987	Current Date: 3/31/2003 Last Revised: (03/10/2003)

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Group: REFRACTORY CERAMIC FIBER PRODUCT
Chemical Name: ALUMINOSILICATE
Synonyms: RCF, ceramic fiber, synthetic vitreous fiber (SVF), man-made vitreous fiber (MMVF), man-made mineral fiber (MMMF)
Trade Names: Kaowool®: S, HS, HS45, SHP
Boards and Shapes

Manufacturer/Supplier:
Thermal Ceramics Inc.
P. O. Box 923; Dept. 300
Augusta, GA 30903-0923

For Product Stewardship and Emergency Information -
Hotline: 1-800-722-5681
Fax: 706-560-4054

For additional MSDSs and to confirm this is the most current MSDS for the product, visit our web page [*www.thermalceramics.com*] or call our automated FaxBack: 1-800-329-7444

2. COMPOSITION / INFORMATION ON INGREDIENTS

COMPONENTS	CAS NUMBER	% BY WEIGHT
Refractories, Fibers, Aluminosilicate	142844-00-6	23 - 64
Silica, fused (amorphous)	60676-86-0	Up to 56
Alumina	1344-28-1	Up to 46
Starch	9005-25-8	4 - 8
Silica, amorphous	7631-86-9	3 - 7
Crystalline silica	14808-60-7 or 14464-46-1	0 - 2

(See Section 8 "Exposure Controls / Personal Protection" for exposure guidelines)

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

WARNING!
POSSIBLE CANCER HAZARD BY INHALATION.

(See Section 11 for more information)

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CHRONIC EFFECT

There has been no increased incidence of respiratory disease in studies examining occupationally exposed workers. In animal studies, long term laboratory exposure to doses hundreds of times higher than normal occupational exposures has produced fibrosis, lung cancer and mesothelioma in rats or hamsters. The fibers used in those studies were specially sized to maximize rodent respirability.

OTHER POTENTIAL EFFECTS

TARGET ORGANS:
Respiratory Tract (nose and throat), Eyes, Skin

RESPIRATORY TRACT (nose and throat) IRRITATION:
If inhaled in sufficient quantity, may cause temporary, mild mechanical irritation to respiratory tract. Symptoms may include scratchiness of the nose or throat, cough or chest discomfort.

EYE IRRITATION:
May cause temporary, mild mechanical irritation. Fibers may be abrasive; prolonged contact may cause damage to the outer surface of the eye.

SKIN IRRITATION:
May cause temporary, mild mechanical irritation. Exposure may also result in inflammation, rash or itching.

GASTROINTESTINAL IRRITATION:
Unlikely route of exposure.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:
Pre-existing medical conditions, including dermatitis, asthma or chronic lung disease may be aggravated by exposure; individuals who have a history of allergies may experience greater amounts of skin and respiratory irritation.

HAZARD CLASSIFICATION

RCF:
Although studies, involving occupationally exposed RCF workers, have not identified any increased incidence of respiratory disease, results from animal testing have been used as the basis for hazard classification. In each of the following cases, the conclusions are qualitative only and do not rest upon any quantitative analysis suggesting that the hazard actually may occur at current occupational exposure levels.

The **International Agency for Research on Cancer (IARC)** confirmed in October 2001 that Group 2B (possible human carcinogen based on sufficient evidence of carcinogenicity in animals but inadequate evidence in humans) continues to be the appropriate classification for refractory ceramic fiber.

The Seventh Annual Report on Carcinogens (1994), prepared by the **National Toxicology Program (NTP)**, classified respirable RCF and glasswool as substances reasonably anticipated to be carcinogens.

The **American Conference of Governmental Industrial Hygienists (ACGIH)** has classified RCF as "A2-Suspected Human Carcinogen."

The **Commission of The European Communities (DG XI)** has classified RCF as a substance "that should be regarded as if it is carcinogenic to man."

The **State of California**, pursuant to Proposition 65, The Safe Drinking Water and Toxic Enforcement Act of 1986, has listed "ceramic fibers (airborne fibers of respirable size)" as a chemical known to the State of California to cause cancer.

The **Canadian Environmental Protection Agency (CEPA)** has classified RCF as "probably carcinogenic" (Group 2).

The **Canadian Workplace Hazardous Materials Information System (WHMIS)** – RCF is classified as Class D2A - Materials Causing Other Toxic Effects.

The **Hazardous Materials Identification System (HMIS)** –
Health 1* Flammability 0 Reactivity 0 Personal Protection Index: X (Employer Determined)
(* denotes potential for chronic effects)

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Crystalline silica:
This product may contain up to 2% of crystalline silica, for which the following apply:

The **International Agency for Research on Cancer (IARC)** has classified crystalline silica inhaled in the form of quartz or cristobalite from occupational sources as carcinogenic to humans (Group 1).

The Ninth Annual Report on Carcinogens (2000), prepared by the **National Toxicology Program (NTP)**, classified silica, crystalline (respirable size), as a substance known to be a human carcinogen.

The **American Conference of Governmental Industrial Hygienists (ACGIH)** has classified crystalline silica (quartz) as "A2-Suspected Human Carcinogen."

The **State of California**, pursuant to Proposition 65, The Safe Drinking Water and Toxic Enforcement Act of 1986, has listed "silica, crystalline (airborne particles of respirable size)" as a chemical known to the State of California to cause cancer.

4. FIRST AID MEASURES

RESPIRATORY TRACT (nose and throat) IRRITATION:
If respiratory tract irritation develops, move the person to a dust free location. See Section 8 for additional measures to reduce or eliminate exposure.

EYE IRRITATION:
If eyes become irritated, flush immediately with large amounts of lukewarm water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Do not rub eyes.

SKIN IRRITATION:
If skin becomes irritated, remove soiled clothing. Do not rub or scratch exposed skin. Wash area of contact thoroughly with soap and water. Using a skin cream or lotion after washing may be helpful.

GASTROINTESTINAL IRRITATION:
If gastrointestinal tract irritation develops, move the person to a dust free environment.

- If the above symptoms persist, seek medical attention. -

NOTES TO PHYSICIANS:
Skin and respiratory effects are the result of temporary, mild mechanical irritation; fiber exposure does not result in allergic manifestations.

5. FIRE FIGHTING MEASURES

NFPA Codes: **Flammability:** 0 **Health:** 1 **Reactivity:** 0 **Special:** 0

NFPA Unusual Hazards:	None
Flammable Properties:	None
Flash Point:	None
Hazardous Decomposition Products:	None
Unusual Fire and Explosion Hazard:	None
Extinguishing Media:	Use extinguishing media suitable for type of surrounding fire

6. ACCIDENTAL RELEASE MEASURES

SPILL PROCEDURES
Avoid creating airborne dust. Dust suppressing cleaning methods such as wet sweeping or vacuuming should be used to clean the work area. If vacuuming, the vacuum should be equipped with a HEPA filter. Compressed air or dry sweeping should not be used for cleaning.

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7. HANDLING AND STORAGE

STORAGE

Store in original container in a dry area. Keep container closed when not in use.

HANDLING

Handle ceramic fiber carefully. Limit use of power tools unless in conjunction with local exhaust. Use hand tools whenever possible. Frequently clean the work area with HEPA filtered vacuum or wet sweeping to minimize the accumulation of debris. Do not use compressed air for clean-up.

EMPTY CONTAINERS

Product packaging may contain residue. Do not reuse.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

EXPOSURE GUIDELINES

MAJOR COMPONENT	*OSHA PEL*	*MANUFACTURER'S REG.*
Refractories, Fibers, Aluminosilicate	None Established*	0.5 f/cc, 8-hr. TWA**

* There is no specific regulatory standard for RCF in the U.S. OSHA's "Particulate Not Otherwise Regulated (PNOR)" standard [29 CFR 1910.1000, Subpart Z, Air Contaminants] applies generally - Total Dust 15 mg/m^3; Respirable Fraction 5 mg/m^3.

** The Refractory Ceramic Fibers Coalition (RCFC) has sponsored comprehensive toxicology and epidemiology studies to identify potential RCF-related health effects [see Section 11 for more details], consulted experts familiar with fiber and particle science, conducted a thorough review of the RCF-related scientific literature, and further evaluated the data in a state-of-the-art quantitative risk assessment. Based on these efforts and in the absence of an OSHA PEL, RCFC has adopted a recommended exposure guideline (REG), as measured under NIOSH Method 7400 B. The manufacturers' REG is intended to promote occupational health and safety through feasible exposure controls and reductions as determined by extensive industrial hygiene monitoring efforts undertaken voluntarily and pursuant to an agreement with the U.S. Environmental Protection Agency.

OTHER OCCUPATIONAL EXPOSURE LEVELS (OEL)

RCF-related occupational exposure limits vary internationally. Regulatory OEL examples include: Australia – 0.5 f/cc; Austria – 0.5 f/cc; Canada – 0.5 to 1.0 f/cc; Denmark – 1.0 f/cc; France – 0.6 f/cc; Germany – 0.5 f/cc (0.25 f/cc for new installations); Netherlands – 1.0 f/cc; New Zealand – 1.0 f/cc; Norway – 2.0 f/cc; Poland – 2.0 f/cc; Sweden – 1.0 f/cc; United Kingdom – 2.0 f/cc. Non-regulatory OEL examples include: ACGIH TLV – 0.2 f/cc; RCFC REG – 0.5 f/cc. The objectives and criteria underlying each of these OEL decisions also vary. The evaluation of occupational exposure limits and their relative applicability to the workplace is best performed, on a case-by-case basis, by a qualified Industrial Hygienist.

OTHER COMPONENTS	*OSHA PEL*	*MANUFACTURER'S REG.*
Silica, amorphous	(80 mg/m^3 ÷ % SiO_2 •) or 20 mppcf	None Established
Starch	15 mg/m^3 (total), 5 mg/m^3 (respirable)	None Established
Crystalline silica	See note • •	None Established

• % SiO_2 = Percent of crystalline silica.

• • Depending on the percentage and type(s) of silica in the mineral, the OSHA Permissible Exposure Limit (PEL) for respirable dust containing silica (8 HR TWA) is based on the formula listed in 29 CFR 1910.1000, "Air Contaminants" under Table Z-3, "Mineral Dust". For quartz containing mineral dust, the PEL = 10 mg/m^3 / (% of silica + 2); for cristobalite or tridymite, the PEL = 5 mg/m^3/ (% of silica + 2); for mixtures, the PEL = 10 mg/m^3 / (% of quartz + 2 (% of cristobalite) + 2 (% of tridymite) + 2).

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OTHER OCCUPATIONAL EXPOSURE LEVELS (OEL)

International occupational exposure levels (OELs), both regulatory and non-regulatory, for the other ingredients in this product may vary. Contact the appropriate, local regulatory authority for current limits. The evaluation of occupational exposure limits and the determination of their relative applicability to the workplace are best performed, on a case-by-case basis, by a qualified Industrial Hygienist.

Non-regulatory OEL examples include: ACGIH TLVs (8 hr., TWA): Silica, amorphous – 10 mg/m^3; Starch – 10 mg/m^3; Silica, fused (amorphous) – 0.1 mg/m^3; Alumina – 10 mg/m^3; Crystalline silica – 0.1 mg/m^3.

ENGINEERING CONTROLS

Use feasible engineering controls such as local exhaust ventilation, point of generation dust collection, down draft work stations, emission controlling tool designs, and materials handling equipment designed to minimize airborne fiber emissions.

PERSONAL PROTECTION EQUIPMENT

Respiratory Protection – RCF:

When engineering and/or administrative controls are insufficient to maintain workplace exposures within the 0.5 f/cc REG, the use of appropriate respiratory protection, pursuant to the requirements of OSHA Standards 29 CFR 1910.134 and 29 CFR 1926.103, is recommended. The following information is provided as an example of appropriate respiratory protection for aluminosilicate fibers. The evaluation of workplace hazards and the identification of appropriate respiratory protection is best performed, on a case-by-case basis, by a qualified Industrial Hygienist.

MANUFACTURER'S RESPIRATORY PROTECTION RECOMMENDATIONS WHEN HANDLING RCF PRODUCTS

Respirable Airborne Fiber Concentration	Respirator Recommendation [1]
Not yet determined but expected to be below 5.0 f/cc based on operation	Half-face, air-purifying respirator equipped with a NIOSH-certified P100 particulate filter cartridge.
"Reliably" less than 0.5 f/cc	See recommendation below for individual worker requests
0.5 f/cc – 5.0 f/cc	Half-face, air-purifying respirator equipped with a NIOSH – certified P100 particulate filter cartridge.
5.0 f/cc – 25 f/cc	Full-facepiece, air-purifying respirator equipped with a NIOSH – certified P100 particulate filter cartridge or PAPR.
Greater than 25 f/cc	PAPR with tight-fitting full facepiece or a supplied air respirator in continuous flow mode.
When individual workers request respiratory protection as a matter of personal comfort or choice and exposures are "reliably" below 0.5 f/cc (8-hr., TWA)	A NIOSH-certified respirator, such as a disposable particulate respirator or respirators with filter cartridges rated N95 or better.

[1] **Note: The P100 recommendation is a conservative default choice; in some cases, solid arguments can be made that other respirator types (e.g., N95, R99, etc.) may be suitable for some tasks or work environments. The P100 recommendation is not designed to limit informed choices, provided that respiratory protection decisions comply with 29 CFR 1910.134.**

Other Information:

- Concentrations based upon an eight-hour time weighted average (TWA) as determined by air samples collected and analyzed pursuant to NIOSH method 7400 (B) for airborne fibers.
- The manufacturer recommends the use of a full-facepiece, air purifying respirator equipped with an appropriate particulate filter cartridge during furnace tear-out events and the removal of used RCF to control exposures to airborne fiber and the potential presence of crystalline silica. If exposure levels are known, the respiratory protection chart provided above may be applied.
- Potential exposure to other airborne contaminants should be evaluated by a qualified Industrial Hygienist for the selection of appropriate respiratory protection and air monitoring.
- In the absence of other objective data or when concentrations are unknown, the manufacturer recommends the use of a half-face, air-purifying respirator equipped with a NIOSH-certified P-100 particulate filter cartridge (See above note).

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Skin Protection:
Wear gloves, head coverings and full body clothing as necessary to prevent skin irritation. Washable or disposable clothing may be used. If possible, do not take unwashed work clothing home. If soiled work clothing must be taken home, employers should ensure employees are trained on the best practices to minimize or avoid non-work dust exposure (e.g., vacuum clothes before leaving the work area, wash work clothing separately, rinse washer before washing other household clothes, etc.).

Eye Protection:
Wear safety glasses with side shields or other forms of eye protection in compliance with appropriate OSHA standards to prevent eye irritation. The use of contact lenses is not recommended, unless used in conjunction with appropriate eye protection. Do not touch eyes with soiled body parts or materials. If possible, have eye-washing facilities readily available where eye irritation can occur.

9. PHYSICAL AND CHEMICAL PROPERTIES

ODOR AND APPEARANCE:	Fiber shapes
CHEMICAL FAMILY:	Aluminosilicate
BOILING POINT:	Not Applicable
WATER SOLUBILITY (%):	Not Soluble in Water
MELTING POINT:	2800°F (1538°C) to 3200°F (1768°C)
SPECIFIC GRAVITY:	>2.5
VAPOR PRESSURE:	Not Applicable
pH:	Not Applicable
VAPOR DENSITY (Air = 1):	Not Applicable
% VOLATILE:	Not Applicable
MOLECULAR FORMULA:	Not Applicable

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY:	Stable under conditions of normal use
INCOMPATIBILITY:	None
CONDITIONS TO AVOID:	None
HAZARDOUS DECOMPOSITION PRODUCTS:	Oxides of carbon and trace of ammonia may be released from starch during initial heating of this product
HAZARDOUS POLYMERIZATION:	Not Applicable

11. TOXICOLOGICAL INFORMATION

HEALTH DATA SUMMARY
Epidemiological studies that include most people who have ever worked in domestic RCF production have indicated no increased incidence of respiratory disease or other significant health effects in occupationally exposed workers. In animal studies, long-term, high-dose inhalation exposure resulted in the development of respiratory disease in rats and hamsters.

EPIDEMIOLOGY

RCF:
The University of Cincinnati is conducting an ongoing epidemiologic investigation. The evidence obtained from employees in U. S. RCF manufacturing facilities is as follows:

1) There is no evidence of any fibrotic lung disease (interstitial fibrosis) from evaluations of chest X-rays.

2) There is no evidence of an elevated incidence of lung disease among RCF manufacturing employees.

3) In early studies an apparent statistical "trend" within the exposed population was observed between RCF exposure

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duration and some measures of lung function. The observations were clinically insignificant. If these observations were made on an individual employee, the results would be interpreted as being within the normal (predicted) respiratory range. A more recent longitudinal study of employees with 5 or more pulmonary function tests refutes the earlier observations, finding no effect on lung function associated with RCF production experience. Initial data (circa 1987) seemed to indicate an interactive effect between smoking and RCF exposure; more recent data, however, found no interactive effect. Nevertheless, to promote good health, RCF employees are still actively encouraged not to smoke.

4) Pleural plaques (thickening along the chest wall) have been observed in a small number of RCF employees. Some studies appear to show a relationship between the occurrence of pleural plaques on chest radiographs and the following variables: (a) years since RCF production hire date; (b) duration of RCF production employment; and (c) cumulative RCF exposure. The best evidence to date indicates that pleural plaques are a marker of exposure only. Pleural plaques are not associated with pulmonary impairment. The pathogenesis of pleural plaques remains incompletely understood; however, the mechanism appears to be an inflammatory response caused by inhaled fibers.

Crystalline silica:
Exposure to crystalline silica can cause silicosis, and exacerbate pulmonary tuberculosis and bronchitis. IARC (Monograph vol. 68, 1997) concluded that "crystalline silica from occupational sources inhaled in the form of quartz or cristobalite is carcinogenic to humans (Group 1)", and noted that "carcinogenicity in humans was not detected in all industrial circumstances studied" and "may be dependent on inherent characteristics of the crystalline silica or on external factors affecting its biological activity".

TOXICOLOGY

RCF:
A number of toxicological studies designed to identify any potential health effects from RCF exposure have been completed. In one study, conducted by the Research and Consulting Company, (Geneva, Switzerland), rats and hamsters were exposed to 30 mg/m³ (about 200 fibers/cc) of specially-prepared RCF for 6 hours/day, 5 days/week, for up to 24 months. In rats, a statistically significant increase in lung tumors was observed; two mesotheliomas (cancer of the pleural lining between the chest wall and lung) were also identified. Hamsters did not develop lung tumors; however, interstitial fibrosis and mesothelioma was found. Some, in the scientific community, have concluded that the "maximum tolerated dose" was exceeded and that significant particle contamination was a confounding issue; therefore, these study findings may not represent an accurate assessment of the potential for RCF to produce adverse health effects.

In a related multi-dose study with a similar protocol, other rats were exposed to doses of 16 mg/m³, 9 mg/m³, 3 mg/m³ which corresponds to about 115, 75, and 25 fibers per cubic centimeter respectively. This study found no statistically significant increase in lung cancer. Some cases of pleural and parenchymal fibrosis were seen in the 16 mg/m³ dose group. Some cases of mild fibrosis and one mesothelioma were observed in the 9 mg/m³ group. No acute respiratory effects were seen in the rats in the 3 mg/m³ exposure group, which suggests that there may be a dose/response threshold, below which irreversible respiratory impacts do not occur.

Other toxicological studies have been conducted which utilized non-physiological exposure methods such as intrapleural, intraperitoneal and intratracheal implantation or injection. Some of these studies have found that RCF is a potential carcinogen. Some experts, however, suggest that these tests have limited relevance because they bypass many of the biological mechanisms that prevent fiber deposition or facilitate fiber clearance.

Crystalline silica:
There is sufficient evidence of carcinogenicity of respirable silica in experimental animals (IARC Monograph; Vol. 42; 1987 and IARC Monograph; Vol. 68; 1997). Inhalation and intratracheal installation of crystalline silica in rats caused lung cancer; however, studies in other species such as mice and hamsters caused no lung cancer. Crystalline silica also caused fibrosis in rats and hamsters in several inhalation and intratracheal installation studies.

Silica, amorphous:

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Toxic effects described in animals from single inhalation exposures of amorphous silica include upper respiratory irritation, lung congestion, bronchitis, and emphysema. Repeated inhalation exposures at concentration of 50 or 150 mg/m3 produced increased lung weights and lung changes. No progressive pulmonary fibrosis was seen and the observed lung changes were reversible. No adverse effects were observed in this study at 10 mg/m3. No animal test reports are available to define the carcinogenic, mutagenic, or reproductive effects.

To obtain more epidemiology or toxicology information, please call the toll free telephone number for the Thermal Ceramics Product Stewardship Program found in Section 16 - Other Information.

12. ECOLOGICAL INFORMATION

No ecological concerns have been identified.

13. DISPOSAL CONSIDERATIONS

WASTE MANAGEMENT:
To prevent waste materials from becoming airborne during waste storage, transportation and disposal, a covered container or plastic bagging is recommended.

DISPOSAL:
RCF, as manufactured, is not classified as a hazardous waste according to Federal regulations (40 CFR 261). As manufactured, RCF was tested using EPA's Toxicity Characteristic Leaching Procedure (TCLP). Results showed there were no detectable contaminants or detectable leachable contaminants that exceeded the regulatory levels. Any processing, use, alteration or chemical additions to the product, as purchased, may alter the disposal requirements. Under Federal regulations, it is the waste generator's responsibility to properly characterize a waste material, to determine if it is a "hazardous" waste. Check local, regional, state or provincial regulations to identify all applicable disposal requirements.

14. TRANSPORT INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION (DOT)

Hazard Class:	Not Regulated	United Nations (UN) Number:	Not Applicable
Labels:	Not Applicable	North America (NA) Number:	Not Applicable
Placards:	Not Applicable	Bill of Lading:	Product Name

INTERNATIONAL

Canadian TDG Hazard Class & PIN: Not regulated
Not classified as dangerous goods under ADR (road), RID (train) or IMDG (ship).

15. REGULATORY INFORMATION

UNITED STATES REGULATIONS

EPA: **Superfund Amendments and Reauthorization Act (SARA)** Title III - This product does not contain any substances reportable under Sections 302, 304, 313, (40 CFR 372). Sections 311 and 312 (40 CFR 370) apply (delayed hazard).
Toxic Substances Control Act (TSCA) – RCF has been assigned a CAS number; however, it is not required to be listed on the TSCA inventory.
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the **Clean Air Act (CAA)** - RCF contains fibers with an average diameter greater than one micron and thus is not considered a hazardous air pollutant.

OSHA: Comply with **Hazard Communication Standards** 29 CFR 1910.1200 and 29 CFR 1926.59 and the **Respiratory Protection Standards** 29 CFR 1910.134 and 29 CFR 1926.103.

TSCA: All substances contained in this product are listed in the TSCA Chemical Inventory

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[Section 8(b)].

California: Ceramic fibers and crystalline silica (airborne particles of respirable size) are listed in **Proposition 65, The Safe Drinking Water and Toxic Enforcement Act of 1986** as a chemical known to the State of California to cause cancer.

Other States: RCF products are not known to be regulated by states other than California; however, state and local OSHA and EPA regulations may apply to these products. If in doubt, contact your local regulatory agency.

INTERNATIONAL REGULATIONS

Canada: **Canadian Workplace Hazardous Materials Information System (WHMIS)** - RCF is classified as Class D2A - Materials Causing Other Toxic Effects
Canadian Environmental Protection Act (CEPA) - All substances in this product are listed, as required, on the Domestic Substances List (DSL)

European Union: **European Directive 97/69/EC** classified RCF as a Category 2 carcinogen; that is it "should be regarded as if it is carcinogenic to man."

16. OTHER INFORMATION

RCF DEVITRIFICATION:

As produced, all RCF fibers are vitreous (glassy) materials that do not contain crystalline silica. Continued exposure to elevated temperatures may cause these fibers to devitrify (become crystalline). The first crystalline formation (mullite) begins to occur at approximately 985° C (1805° F). Crystalline silica (cristobalite) formation may begin at temperatures of approximately 1200° C (2192° F). The occurrence and extent of crystalline phase formation is dependent on the duration and temperature of exposure, fiber chemistry and/or the presence of fluxing agents. The presence of crystalline phases can be confirmed only through laboratory analysis of the "hot face" fiber.

IARC's evaluation of crystalline silica states "Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1)" and additionally notes "in making the overall evaluation, the Working Group noted that carcinogenicity in humans was not detected in all industrial circumstances studied. Carcinogenicity may be dependent on inherent characteristics of the crystalline silica or on external factors affecting its biological activity or distribution of its polymorphs." (IARC Monograph Vol. 68, 1997). NTP lists all polymorphs of crystalline silica amongst substances which may "reasonably be anticipated to be carcinogens."

IARC and NTP did not evaluate after-service RCF, which may contain various crystalline phases. However, an analysis of after-service RCF samples obtained pursuant to an exposure monitoring agreement with the EPA, found that in the furnace conditions sampled, most did not contain detectable levels of crystalline silica. Other relevant RCF studies found that (1) simulated after-service RCF showed little, or no, activity where exposure was by inhalation or by intraperitoneal injection; and (2) after-service RCF was not cytotoxic to macrophage-like cells at concentrations up to 320 $\mu g/cm^2$ - by comparison, pure quartz or cristobalite were significantly active at much lower levels (circa 20 $\mu g/cm^2$).

RCF AFTER-SERVICE REMOVAL:

Respiratory protection should be provided in compliance with the Product Stewardship Program and OSHA standards. During removal operations, a FULL FACE RESPIRATOR is recommended to reduce inhalation exposure along with eye and respiratory tract irritation. A specific evaluation of workplace hazards and the identification of appropriate respiratory protection is best performed, on a case-by-case basis, by a qualified industrial hygiene professional.

PRODUCT STEWARDSHIP PROGRAM:

Thermal Ceramics has established a program to provide customers with up-to-date information regarding the proper use and handling of RCF. In addition, Thermal Ceramics has established a program to monitor airborne fiber concentrations at customer facilities. If you would like more information about this program, please call the Thermal Ceramics Product Stewardship Information Hotline at 1-800-722-5681.

DEFINITIONS:

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ACGIH:	American Conference of Governmental Industrial Hygienists
ADR:	Carriage of Dangerous Goods by Road (International Regulation)
CAA:	Clean Air Act
CAS:	Chemical Abstracts Service
CERCLA:	Comprehensive Environmental Response, Compensation and Liability Act
DSL:	Domestic Substances List
EPA:	Environmental Protection Agency
EU:	European Union
f/cc:	Fibers per cubic centimeter
HEPA:	High Efficiency Particulate Air
HMIS:	Hazardous Materials Identification System
IARC:	International Agency for Research on Cancer
IATA:	International Air Transport Association
IMDG:	International Maritime Dangerous Goods Code
mg/m³:	Milligrams per cubic meter of air
mmpcf:	Million particles per cubic meter
NFPA:	National Fire Protection Association
NIOSH:	National Institute for Occupational Safety and Health
OSHA:	Occupational Safety and Health Administration
29 CFR 1910.134 & 1926.103:	OSHA Respiratory Protection Standards
29 CFR 1910.1200 & 1926.59:	OSHA Hazard Communication Standards
PEL:	Permissible Exposure Limit (OSHA)
PIN:	Product Identification Number
PNOC:	Particulates Not Otherwise Classified
PNOR:	Particulates Not Otherwise Regulated
PSP:	Product Stewardship Program
RCFC:	Refractory Ceramic Fibers Coalition
RCRA:	Resource Conservation and Recovery Act
REG:	Recommended Exposure Guideline (RCFC)
REL:	Recommended Exposure Limit (NIOSH)
RID:	Carriage of Dangerous Goods by Rail (International Regulations)
SARA:	Superfund Amendments and Reauthorization Act
SARA Title III:	Emergency Planning and Community Right to Know Act
SARA Section 302:	Extremely Hazardous Substances
SARA Section 304:	Emergency Release
SARA Section 311:	MSDS/List of Chemicals and Hazardous Inventory
SARA Section 312:	Emergency and Hazardous Inventory
SARA Section 313:	Toxic Chemicals and Release Reporting
STEL:	Short Term Exposure Limit
SVF:	Synthetic Vitreous Fiber
TDG:	Transportation of Dangerous Goods
TLV:	Threshold Limit Value (ACGIH)
TSCA:	Toxic Substances Control Act
TWA:	Time Weighted Average
WHMIS:	Workplace Hazardous Materials Information System (Canada)

Revision Summary: Text additions: Section 11, Toxicology-Crystalline Silica and Section 15, US-Regulations-TSCA.

MSDS Prepared By: THERMAL CERAMICS ENVIRONMENTAL, HEALTH & SAFETY DEPARTMENT

DISCLAIMER

The information presented herein is presented in good faith and believed to be accurate as of the effective date of this Material Safety Data Sheet. Employers may use this MSDS to supplement other information gathered by them in their efforts to assure the health and safety of their employees and the proper use of the product. This summary of the relevant data reflects professional judgment; employers should note that information perceived to be less relevant has not been included in this MSDS. Therefore, given the summary nature of this document, Thermal Ceramics does not extend any warranty (expressed or implied), assume any responsibility, or make any representation regarding the completeness of this information or its suitability for the purposes envisioned by the user.

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Material Safety Data Sheet

Bead Release

This Material Safety Data Sheet (MSDS) contains toxicology, industrial hygiene and environmental information. Please make sure that all users are provided with this information.

Material Name: Bead Release
Manufacturer: Hot Glass Beads
1722 N College Ave, C308
Fayetteville, AR 72703

Telephone #: Product Information 561 371-9021

Material	***Exposure Limits***	***References***
Powdered Silicates	2mg/m3 (RF) TWA-TVL for dust containing No asbestos and <1% crystalline silica	ACGIH 97
	15 mg/m3 (TD) TWA-PEL	OSHA (29CFR1910)
	5 mg/m3 (RF) TWA-PEL	OSHA (28CFR1810)
	10 mg/m3 (TD) TWA-PEL	OSHA 89 (vacated)
	TD = Total Dust	Vacated PELs are not federally enforceable but may be in certain states
	RF= respireable fraction	
	0.l mg/m3 (RF) TWA-TVL	ACGIH 97
	TWA-PEL (TD): 30 mg/m3 divided by (% 5lO2 + 2)	OSHA (29CFR1910)

Hazards Identification:
Appearance and Odor: Grey odorless powder
Statement of Hazard: CAUTION
Acute Hazards: *May cause upper respiratory tract irritation
*May irritate eyes, skin and mucous membranes
*Avoid generating or breathing dust
Chronic Hazards: *Inhalation may cause delayed lung injury and lung cancer
1998 North American Emergency Response Guidebook: NA

Potential Exposure Routes: Eyes, skin contact, inhalation and, less likely, ingestion. Dust inhalation is typically the most significant exposure route. The degree of injury will depend first upon exposure dose, duration of exposure and speed and thoroughness of aid treatment.

Acute Effects:
-inhalation may irritate the respiratory tract and cause coughing and shortness of breath
-contact may irritate the eyes, skin and mucous membranes – primarily from friction
Non Carcinogenic Chronic Effects: Chronic inhalation may lead to emphysema, silicosis and pulmonary fibrosis
Cancer: One component of this product, crystalline quartz, is listed as a carcinogen or potential carcinogen by NTP and IARC. Crystalline silica is listed on the State of Califomia's Safe Drinking Water and Toxic Enforcement Act of 1986 list of chemicals known to cause cancer.

Medical conditions generally aggravated by exposure: People with pre-existing respiratory conditions, especially chronic lung disease or emphysema or pre-existing kidney disorders, might be more sensitive.

First Aid Measures:
Flush skin and eyes with water. Remove contaminated clothing.

Follow OSHA respirator regulations (29 CFR 1910.134) when using, mixing and removing dry bead release.

Wear safety glasses or face shield to protect eyes from exposure to dry mix.

Use appropriate local ventilation.

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Physical and Chemical Properties:

Appearance and Odor:	Grey odorless powder		
Boiling Point:	NDA	Solubility in Water:	Low
Vapor Pressure:	Essentially Zero	Volatiles (% by Volume):	0
Specific Gravity:	NDA	Evaporation Rate:	NA
Vopor Density (Air=1)	NA	Flash Point:	NA

General: This product will not polymerize. This product is stable.

Ecological Information:

Ecotoxicity: This product poses minimal risk to the environment.

D.O.T. Proper Shipping Name: Not regularized as a hazardous material

Section 311/312 Hazard Categories (40CFR 370): This product has been reviewed according to the EPA Hazard categories promulgated under Section 311 and 312 of SARA and is considered, under applicable definitions, to meet the following categories:

Immediate (acute) health effects:	No
Delayed chronic health effects:	Yes
Fire Hazard:	No
Sudden release of pressure hazard:	No
Reactivity Hazard:	No

While the information set forth herein is believed to be accurate as of the date hereof, neither the Company nor the Hazard Information Services make any warranty or guarantee, expressed or implied and disclaim all liability arising out of the use of this information.

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