SDS No: 5001
Revision: 5
Date of last revision: 05/05/2015

SAFETY DATA SHEET

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY/UNDERTAKING

1.1 Product Identifier

Trade Names: **PYROLITE; PYROBOARD; PYROBOARD GH; FORMCAST 60; FORMCAST 75; FORMCAST 110**

Substance Name: **Mixture containing Refractory Ceramic Fibers (RCF)/Alumino-Silicate Wools (ASW)**
Index Number: 650-017-00-8 (CLP Annex VI)
CAS Number: 142844-00-6
CAS Name: refractories, fibers, aluminosilicate
Registration Number: 01-2119458050-50-000x

1.2 Relevant Identified Uses

Refractory shapes for "professional users" in industrial applications involving high temperature, heat treating, and molten metal processing.

1.3 Details of the Supplier of the SDS

RMG
Rex Materials Group
P.O. Box 287
Howell, MI 48844
(517) 223-3787, (517) 338-5062, fax
info@rexmaterials.com

1.4 Emergency Telephone Number

Chemtrec North America: (800) 424-9300
Chemtrec Outside North America: +1 (703) 527-3887

2. HAZARDS IDENTIFICATION

2.1 Classification of the Substance or Mixture

The U.S. Occupational Safety and Health Administration (OSHA) Hazard Communication Standard (HCS) 2012 indicates that IARC group 2B corresponds to OSHA HCS 2012 Category 2 carcinogen classification (see, e.g., §1910.1200, Appendix F, Part D). Under OSHA HCS 2012, RCF is classified as a Category 2 carcinogen.

2.2 Labeling Elements

2.2.1 Hazard Pictogram

2.2.2 Signal Word

Warning

2.2.3 Hazard Statements

Suspected of causing cancer by inhalation.

2.2.4 Precautionary Statements

Do not handle until all safety instructions have been read and understood.
Use respiratory protection as required; see section 8 of the Safety Data Sheet
If concerned about exposure, get medical advice.
Store in a manner to minimize airborne dust.
Dispose of waste in accordance with local, state and federal regulations.

2.3 Other Hazards

Mild mechanical irritation to skin, eyes, and upper respiratory system may result from exposure. These effects are usually temporary.

2.4 Hazardous Materials Identification System (HMIS)

Health: 1* Flammability: 0 Reactivity: 0 Personal Protection Index: X (Employer Determined)
(* denotes potential for chronic effects)

3. COMPOSTION/INFORMATION ON INGREDIENTS

Name	CAS No	Index or EINECS No.	Weight %	Classification HCS 2012
RCF/ASW	142844-00-6	650-017-00-8	40-95	Category 2 carc.
Amorphous Silica	7631-86-9	231-545-4	0-60	not classified
Inert Materials	na	na	0-40	na

4. FIRST AID MEASURES

4.1 Description of First Aid Measures

4.1.1 Inhalation:

If respiratory tract irritation develops, move the person to a dust free location. Get medical attention if the irritation continues. See Section 8 for additional measures to reduce or eliminate exposure.

4.1.2 Eye Contact:

If eyes become irritated, flush immediately with large amounts of lukewarm water. Eyelids should be held away from the eyeball to ensure thorough rinsing. Do not rub eyes. Get medical attention if irritation persists.

4.1.3 Skin Irritation:

Handling of this material may cause mild mechanical temporary skin irritation. If this occurs, rinse affected areas with water and wash gently. Do not rub or scratch exposed skin. Using a skin cream or lotion after washing may be helpful.

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

4.2 Most Important Symptoms and Effects, Both Acute and Delayed
Mild mechanical irritation to skin, eyes, and upper respiratory system may result from exposure. These effects are usually temporary.

4.3 Indication of any Immediate Medical Attention and Special Treatment Needed.
Treat symptomatically. Skin and respiratory effects are the result of temporary, mild mechanical irritation; exposure does not result in allergic manifestations.

5. FIREFIGHTING MEASURES

5.1 Extinguishing Media
Products are non-combustible. Use extinguishing media suitable for type of surrounding combustible materials.

5.2 Special Hazards Arising from the Substance or Mixture
See Section 10.6 (due to starch burnout).

5.3 Advice for Firefighters
Use protective equipment and precautions appropriate for type of surrounding fire.

5.4 National Fire Protection Association (NFPA) Codes
Flammability: 0 Health: 1 Reactivity: 0 Special: 0

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal Precautions, Protective Equipment, and Emergency Procedures
Avoid dust formation. Use protective equipment and evacuate unnecessary personnel if appropriate. See Section 8, Exposure Controls/Personal Protection.

6.2 Environmental Precautions
None known.

6.3 Methods for Cleaning Up
Pick up and arrange disposal with minimal dust creation. Vacuum (HEPA) or wet sweep as appropriate. Do not use compressed air for clean up.

7. HANDLING AND STORAGE

7.1 Precautions for Safe handling
Avoid dust formation and its accumulation. Handle in accordance with good industrial hygiene and safety practices. Limit the use of power tools unless in conjunction with local exhaust ventilation. Wear personal protective equipment as outlined in Section 8.2.2.

7.2 Conditions for Safe Storage, Including and Incompatibilities
Keep dry. Protect against water and moisture. Product packaging may contain residue. Do not reuse. Minimize dust emissions during unpacking.

7.3 Specific End Use(s)
See Section 1.2.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 Control Parameters
Industrial hygiene standards and occupational exposure limits vary between countries and local jurisdictions. Check which exposure levels apply to your facility and comply with local regulations. A qualified industrial hygienist can assist with specific workplace evaluation including recommendations for respiratory protection. Examples of national exposure limits are provided in the table below.

	Exposure Limits		
	RCF/ASW	**Amorphous Silica**	**Inert Materials**
US OSHA	na*	80 mg/m^3 / % SiO_2	5 mg/m^3 (resp.)
ACGIH	0.2 f/cc	10 mg/m^3	10 mg/m^3
Argentina	0.2 f/cc	na	10 mg/ m^3
Australia	0.5 f/cc	2 mg/m^3	10 mg/ m^3
Austria	0.5 f/cc	0.3 mg/m^3	6 mg/ m^3
Belgium	0.5 f/cc	na	3 mg/ m^3
Canada	0.2-1.0 f/cc	na	na
Denmark	1.0 f/cc	na	5 mg/ m^3
Egypt	na	na	na
EU	na	na	na
Finland	0.2 f/cc	na	na
France	0.1 f/cc	na	5 mg/ m^3
Germany	0.2 f/cc	4 mg/m^3	3 mg/ m^3
Hungary	na	na	na
Iceland	1.0 f/cc	na	na
India	na	10 mg/m^3	na
Italy	0.2 f/cc	na	3 mg/ m^3
Poland	0.5 f/cc	na	na
Spain	0.5 f/cc	na	3 mg/ m^3
Sweden	0.2 f/cc	na	5 mg/ m^3
The Netherlands	0.5 f/cc	na	5 mg/ m^3
UK	1.0 f/cc	6 mg/m^3	4 mg/ m^3
United Arab Emirates	na	na	na
Venezuela	0.2 f/cc	na	na

* Except for the state of California, where the PEL for RCF is 0.2 f/cc 8-hr TWA, there is no specific regulatory standard for RCF in the U.S. In the absence of an OSHA PEL, the HTIW Coalition has adopted a recommended exposure guideline (REG) of 0.5 f/cc, as measured under NIOSH Method 7400 B. For further information on the history and development of the REG see "Rationale for the Recommended Exposure Guideline" at Attachment II of the HTIW Coalition Product Stewardship Program http://www.htiwcoalition.org/documents/PSP_2012.pdf .

8.2 Exposure Controls
8.2.1 Appropriate Engineering Controls:
Use 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 particulate emissions. If necessary, consult an industrial hygienist to design workplace controls and practices.

8.2.2 Personal Protection Equipment:

Respiratory Protection:

When engineering and/or administrative controls are insufficient, 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 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.

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.

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 clothing home. If soiled work clothing must be taken home, employers should ensure employees are thoroughly 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.).

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE AND ODOR:	white, gray, or tan board or shape / no odor
pH:	na
MELTING POINT:	>1650° C (3002° F)
BOILING POINT:	na
FLASH POINT:	na
EVAPORATION RATE:	na
FLAMMABILITY:	non-flammable
EXPLOSIVE LIMITS:	not explosive
VAPOR PRESSURE:	na
VAPOR DENSITY (Air = 1):	na
BULK DENSITY:	0.2-1.2 g/cc
SOLUBILITY (%):	insoluble
PARTITION COEFFICIENT:	na
AUTO-IGNITION TEMPERATURE:	na
DECOMPOSITION TEMPERATURE:	na (see Section 10.6)
VISCOSITY:	na for a solid

10. STABILITY AND REACTIVITY

10.1 Reactivity

None.

10.2 Chemical Stability

Stable under conditions of normal use.

10.3 Possibility of Hazardous Reactions

None.

10.4 Conditions to Avoid
None. Please refer to handling and storage advice in Section 7.
10.5 Incompatible Materials
None.

10.6 Hazardous Decomposition Products
During the first exposure to temperatures above about 200°C (392°F), an organic binder, if present, may start to oxidize releasing smoke, carbon monoxide, and carbon dioxide. Use adequate ventilation or other precautions to avoid exposure to resultant vapors. Exposure to thermal decomposition fumes may cause respiratory tract irritation, bronchial hyper-reactivity, or an asthmatic-type response.

Exposure to temperatures above approximately 1000°C (1832°F) may lead to the formation of crystalline silica. The occurrence and extent of crystalline phase formation is dependent on the duration and temperature of exposure and/or the presence of fluxing agents. The presence of crystalline phases can be confirmed only through laboratory analysis of the "hot face" material. Please refer to Section 11.4 for more information on “after-service” RCF.

11. TOXICOLOGICAL INFORMATION

Pyrolite, Pyroboard, and Formcast products vary in hardness and friability. Especially if cut, ground, or otherwise broken up, exposure may be possible, predominantly by inhalation or ingestion of the dusts. The primary and most significant constituent of the dust is RCF/ASW, so the toxicological information provided below is exclusively related to RCF/ASW.

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.

11.1 Toxicokinetics, Metabolism and Distribution
11.1.1 Basic Toxicokinetic
Exposure is predominantly by inhalation or ingestion. Man made vitreous fibers of a similar size to RCF/ASW have not been shown to migrate from the lung and/or gut and do not become located in other parts of the body. When compared to many naturally occurring minerals, RCF/ASW has a low ability to persist and accumulate in the body (half-life of long fibers (>20 µm) in 3 week rat inhalation test is approx. 60 days).

11.1.2 Human Toxicological data
In order to determine possible human health effects following RCF exposure, the University of Cincinnati has been conducting medical surveillance studies on RCF workers in the U.S. The Institute of Occupational Medicine (IOM) has conducted medical surveillance studies on RCF workers in European manufacturing facilities.

Pulmonary morbidity studies among production workers in Europe and USA have demonstrated an absence of interstitial fibrosis and no decrement in lung function associated with current exposures, but have indicated a reduction of lung capacity among smokers.

A statistically significant correlation between pleural plaques and cumulative RCF exposure was evidenced in the USA longitudinal study.

The USA mortality study did not show evidence of increased lung tumor development either in the lung parenchyma or in the pleura.

11.2 Information on Toxicological effects
Acute toxicity: short term inhalation
No data available: Short term tests have been undertaken to determine fiber (bio) solubility rather than toxicity; repeat dose inhalation tests have been undertaken to determine chronic toxicity and carcinogenicity.

Acute toxicity: oral
No data available: Repeated dose studies have been carried out using gavage. No effect was found.

Skin corrosion/irritation:
Not a chemical irritant according to test method OECD no. 404

Serious eye damage/irritation:
Not possible to obtain acute toxicity information due to the nature of the substance

Respiratory or skin sensitization
No evidence from human epidemiological studies of any respiratory or skin sensitization potential

G*erm cell mutagenicity*
Method: In vitro micronucleus test
Species: Hamster (CHO)
Dose: 1-35 mg/ml
Routes of administration: In suspension
Results: Negative

Carcinogenicity
Method: Inhalation. Multi-dose
Species: Rat,
Dose: 3 mg/m3, 9 mg/m3 and 16 mg/m3
Routes of administration: Nose only inhalation
Results: Fibrosis just reached significant levels at 16 and 9 mg/m3 but not at 3 mg/m3. None of the parenchymal tumor incidences were higher than the historical control values for this strain of animal.

Method: Inhalation. Single dose
Species: Rat
Dose: 30 mg/m3
Routes of administration: Nose only inhalation
Results: This study was designed to test the chronic toxicity and carcinogenicity of RCF at extreme exposures. Tumor incidence (incl. mesothelioma) was raised at this dose level. The presence of overload conditions (only detected after the experiment was completed), whereby the delivered dose exceeded the clearance capability of the lung, makes meaningful conclusions in terms of hazard and risk assessment difficult.

Method: Inhalation. Single dose
Species: Hamster
Dose: 30 mg/m3
Routes of administration: Nose only inhalation
Results: This low quality study in hamsters (no justification for exposure concentration used and pre existing and concurrent infections in the test animals) produced mesothelial lesions of uncertain significance. Subsequent studies in hamsters with glass fibers indicated that the lung burdens of RCF in this experiment were between 5 and 10 times more than that needed to produce overload, and the results are therefore difficult to interpret.

There are reports of injection studies with some similar materials. While some intraperitoneal injection (IP) studies reported the development of tumors in rats, the relationship of these results to classification remains controversial. Interpretation of these animal experiments is complex, and there is not agreement amongst scientists internationally. A summary of the evidence relating to RCF carcinogenicity in vivo can be found in SCOEL/SUM/165 and in Utel and Maxim 2010.

Reproductive toxicity;
Method: Gavage
Species: Rat
Dose: 250 mg/kg/day
Routes of administration: Oral
Results: No effects were seen in an OECD 421 screening study. There are no reports of any reproductive toxic effects of mineral fibers. Exposure to these fibers is via inhalation and effects seen are in the lung. Clearance of fibers is via the gut and the feces, so exposure of the reproductive organs is extremely unlikely.

STOT-Single exposure; NA
STOT-Repeated exposure; NA
Aspiration hazard: NA

11.3 Irritant Properties
Negative results have been obtained in animal studies (EU method B 4) for skin irritation. Inhalation exposures using the nose only route produce simultaneous heavy exposures to the eyes, but no reports of excess eye irritation exist. Animals exposed by inhalation similarly show no evidence of respiratory tract irritation.

Human data confirm that only mechanical irritation, resulting in itching, occurs in humans, Screening at manufacturers' plants in the UK has failed to show any human cases of skin conditions related to fiber exposure.

11.4 Other Information
After-service RCF may contain various crystalline phases, generally confined to a thin layer of material at the "hot-face" side of these products. 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 microg/cm^2; by comparison, pure quartz or cristobalite, two of the primary phases of silica, were significantly active at much lower levels circa 20 microg/cm^2.

11.5 International Agency for Research on Cancer and National Toxicology Program
IARC, in 1988, Monograph v.43 (and later reaffirmed in 2002, v.81), classified RCF as possibly carcinogenic to humans (group 2B). IARC evaluated the possible health effects of RCF as follows:

- There is inadequate evidence in humans for the carcinogenicity of RCF.
- There is sufficient evidence in experimental animals for the carcinogenicity of RCF.

The Annual Report on Carcinogens (latest edition), prepared by NTP, classified respirable RCF as "reasonably anticipated" to be a carcinogen).

Not classified by OSHA.

12. ECOLOGICAL INFORMATION

These products are inert materials that remain stable overtime. They are insoluble in the natural environment and are chemically identical to inorganic compounds found in the soil and sediment No adverse effects on the environment have been identified or are anticipated.

13. DISPOSAL CONSIDERATIONS

13.1 Waste Treatment
Waste from these products may be generally disposed of at a landfill which has been licensed for this purpose. Unless wetted, such a waste may be dusty and should be properly sealed in containers for disposal. At some authorized disposal sites, dusty waste may be treated differently in order to ensure they are dealt with promptly and to avoid being wind blown. This product, as manufactured, is not classified as a listed or characteristic hazardous waste according to U. S. Federal regulations (40 CFR 261). Any processing, use, alteration or chemical additions to the product, as purchased, may alter the disposal requirements.

Under U. S. 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.

13.2 Additional Information

When disposing of waste and assigning European Waste Code, any possible contamination during use will need to be considered and expert guidance sought as necessary. Please check for any national and/or regional regulations, and refer to the European list (Decision No 2000/532/CE as modified) to identify appropriate waste numbers.

14. TRANSPORT INFORMATION

Not classified as dangerous goods under relevant international transport regulations (ADR, RID, ICAO/IATA, IMDG, ADN).

15. REGULATORY INFORMATION

15.1 U.S. 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).

Hazard Categories

Immediate Hazard – No
Delayed Hazard – Yes
Fire Hazard – No
Pressure Hazard – No
Reactivity Hazard - No

Toxic Substances Control Act (TSCA) – RCF has been assigned a CAS number; however, it is a simple mixture and therefore not required to be listed on the TSCA inventory. Other substances in this product are listed, as required, on the TSCA inventory. The components of RCF are listed on the 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.

California:

"Ceramic fibers (airborne particles of respirable size)" is 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.

15.2 European Regulations

RCF is classified under the CLP (classification, labeling and packaging of substances and mixtures) regulation as a category 1B carcinogen. On January 13, 2010 the European Chemicals Agency (ECHA) updated the candidate list for authorization (Annex XV of the REACH regulation) and added 14 new substances in this list including aluminosilicate refractory ceramic fibers.

As a consequence, EU (European Union) or EEA (European Economic Area) suppliers of articles which contain aluminosilicate refractory ceramic fibers in a concentration above 0.1% (w/w) have to provide sufficient information, available to them, to their customers or upon requests to a consumer within 45 days of the receipt of the request. This information must ensure safe use of the article, and as minimum contains the name of the substance.

15.3 Canadian Regulations

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 Substance List (DSL).

16. OTHER INFORMATION

16.1 Abbreviations and Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists
ADN	European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways
ADR	Transport by road, Council Directive 94/55/EC
ASW	Alumino-Silicate Wool
CARE	Controlled and Reduced Exposure
CAS	Chemical Abstracts Service
CLP	Regulation (EC) No 1272/2008 on Classification, Labeling and Packaging of substances and mixtures
DSL	Domestic Substance List
EEA	European Economical Area
ECFIA	European Ceramic Fibre Industry Association
EINECS	European Inventory of Existing Chemical Substances
EPA	Environmental Protection Agency
EU	European Union
f/cc	fibers per cubic centimeter
g/cc	grams per cubic centimeter
GHS	Globally Harmonized System of Classification and Labeling Chemicals
HCS 2012	Hazard Communication Standard of 2012
HNOC	Hazards Not Otherwise Classified
HTIWC	High Temperature Insulating Wool Coalition
IARC	International Agency for Research on Cancer
ICOA/IATA	Regulations relating to transport by air
IMDG	Regulations relating to transport by sea
mg/ m^3	milligrams per cubic meter
na	not available or not appropriate
OSHA	the U.S. Occupational Safety and Health Administration
PEL	Permissible Exposure Limit (OSHA)
RCF	Refractory Ceramic Fiber
REACH	Regulation (EC) No 1907/2006 dated 18 December 2006 on Registration, Evaluation, Authorization and Restriction of Chemicals
RID	Transport by rail, Council Directive 96/49/EC
SARA	Superfund Amendment and Reauthorization Act
SDS	Safety Data Sheet (replaces MSDS, Material Safety Data Sheet)
STOT	Specific Target Organ systemic Toxicity
WHMIS	Workplace Hazardous Materials Information System

16.2 References

"Good Working Practices," HTIW Coalition, July 2012, htiwcoalition.org
"CARE Guidance Documents," ECFIA industrial hygiene guidance programme, ecfia.eu
"Hazards from the Use of Refractory Ceramic Fibre," HSE 267 (1998)
Numerous other publications can be found at the websites of ECFIA and HTIWC.

16.3 Revision Summary
Rev 5 comprehensive revision to align with HCS 2012

The information contained herein is presented in good faith and is believed to be accurate as of the effective date of this Safety Data Sheet. Employers may use this SDS to supplement other information available to them in their efforts to assure the health and safety of their employees and the proper use of the product. Given the summary nature of this document, Rex Materials Group does not make any warranty (express 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. Further, Rex Materials Group disclaims any responsibility for damage or injury resulting from abnormal use of the product, failure to adhere to recommended practices, or any hazards inherent in the nature of the product.