DENTSPLY International

Material Safety Data Sheet

Ransom & Randolph

1. Product and Company Name

Product Name Investment 909, 910, 908, 903, 811, 815, 910X, 915X, 815A, 965, 975, 220, 980	*MSDS Code Number* 006
Trade Name & Synonyms Calcium sulfate bonded investment	*Date of Last Revision* 09/03
Chemical Name Inorganic mineral	*Manufacturer* Ransom & Randolph
C.A.S. Number	*Address* 3535 Briarfield Blvd, Maumee, OH 43537
Grades or Minor Variant Identities	*Information Telephone Number* 419/865-9497 FAX 419/865-9997
Product Use Investment for low temperature alloys and glass	*Emergency Telephone Number* 419/865-9497

2. Composition

Hazardous Components	C.A.S. Number	%
Silica (quartz)	14808-60-7	<40
Silica (cristobalite)	14464-46-1	<65
Mullite	1302-93-8	<30
Calcium sulfate	7778-18-9	<40
Fibrous glass	65997-17-3	<5

3. Hazardous Identification

Emergency Overview These products contain crystalline silica. Do not breathe dust. May cause delayed lung injury (silicosis, pneumoconiosis).

Routes of Exposure	*Signs & Symptoms*	*Single, Repeated, or Lifetime Exposure*	*Severity (Mild, Moderate, Severe)*	*Acute and Chronic Health Effect(s)*	*Target Organ(s)*
Eye	Irritation				
Skin	Irritation				
Inhalation	Cough, tightness in chest, shortness of breath, wheezing and sputum production	Silicosis	Silicosis	Silicosis	Lungs
Ingestion	Not likely route.				
Other					

Medical Conditions Aggravated by Exposure

Any pre-existing respiratory or pulmonary disease or condition, such as, but limited to, bronchitis, emphysema, and asthma. Individuals with silicosis are predisposed to develop tuberculosis.

Carcinogenicity (IARC, NTP)

NTP: Yes	The National Toxicology Program (NTP) published its Ninth Annual Report on Carcinogens which concludes that "silica, crystalline (respirable)" is known to be a human carcinogen. The NTP conclusion is based on sufficient evidence for the carcinogenicity of respirable crystalline silica in experimental animals and limited evidence in humans.
IARC: Yes	IARC Monographs Volume 68: Silica, silicates, coal dust, and para-aramid fibrils states that there is sufficient evidence in humans for the carcinogenicity of inhaled crystalline silica in the forms of quartz and cristobalite from occupational sources. Crystalline silica is categorized in the "Group 1" category which the IARC defines as the agent in carcinogenic to humans.

OTHER: California Proposition 65	Crystalline Silica (quartz) is classified as a substance known to the State of California to be a carcinogen.

Potential Environmental Effects
No ecotoxicity data is available. This product is not expected to present an environmental hazard.

4. First Aid Measures

Routes of Exposure	*First Aid Instructions*	*Immediate Medical Attention*	*Delayed Effects*
Eye	Flush with plenty of water.	If discomfort or irritation persists, consult a physician.	
Skin	Wash with soap and water.	If discomfort or irritation persists, consult a physician.	
Inhalation	Remove affected person to fresh air.	If discomfort or irritation persists, consult a physician.	
Ingestion	Drink water. Do not induce vomiting.	If discomfort or irritation persists, consult a physician.	
Other			

Note to Physicians (Treatment, Testing, and Monitoring)

5. Fire-fighting Measures

Flashpoint: (Method)	*Flammable (Explosive) Limits in Air*		*Autoignition Temperature:*	*Other*
N/A	LEL: N/A	*UEL:* N/A		Do not inhale dust. Wear respirator.

Flame Propagation or Burning Rate (for solids):	*Properties Contributing to Fire Intensity*	*Flammability Classification NFDA Rating*:
This product will not burn.		0

Extinguishing Media	*Extinguishing Media to Avoid*	
This product is compatible with all extinguishing media.	Use any media appropriate for the surrounding fire.	

Protection and Procedures for Firefighters:
Do not inhale dust. Avoid eye and skin contact.

Unusual Fire and Explosion Hazards:
Contact with powerful oxidizing agents such as fluoride, chlorine, trifluoride, manganese oxide, oxygen difluoride, hydrogen peroxide, etc. may cause fires.

6. Accidental Release Measures

Containment Techniques

Spill/Leak Clean-Up Procedures and Equipment
Use dustless methods (vacuum) and place into closable container for disposal, or flush with water. Do not dry sweep. Wear protective equipment.

Evacuation Procedures

Special Instructions

Reporting Requirements
Consult and comply with current national, regional, state, and local regulations.

7. Handling and Storage

Handling Practices and Warnings

Avoid breakage of packaged materials or spills of bulk material.

Storage Practices and Warnings

Use dustless systems for handling, storage and clean up so that airborne dust does not exceed the PEL. Use adequate ventilation and dust collection. Practice good housekeeping. Do not permit dust to collect on walls, floors, sills, ledges, machinery, or equipment. Maintain, clean and fit test respirators in accordance with OSHA regulations. Maintain and test ventilation and dust collection equipment. Wash or vacuum clothing which has become dusty. See also control measures in Section VIII.

See OSHA Hazard Communication Rule 29 CFR Sections 1910.1200, 1915.99, 1917.28, 1918.90, 1926.59 and 1928.21, and state and local worker or community "right to know" laws and regulations. We recommend that smoking be prohibited in all areas where respirators must be used. WARN YOUR EMPLOYEES (AND CUSTOMERS-USERS IN CASE OF RESALE) BY POSTING AND OTHER MEANS OF THE HAZARD AND OSHA PRECAUTIONS TO BE USED. PROVIDE TRAINING FOR YOUR EMPLOYEES ABOUT THE OSHA PRECAUTIONS.

See also American Society for Testing and Materials (ASTM) Standard Practice E1132-86, "Standard Practice for Health Requirements Relating to Exposure to Quartz Dust."

8. Exposure Controls/Personal Protection

Ventilation	*Other Engineering Controls* Use sufficient local exhaust to reduce the level of respirable dust to the permissible exposure limit. See “Industrial Ventilation, A Manual of Recommended Practice,” the latest edition.	
Routes of Entry:	*Personal Protective Equipment (PPE) for Normal Use:*	*PPE for Emergencies:*
Eye/Face	Wear protective shield (safety glasses) when exposed to dust particles.	
Skin	Boots, aprons, protective gloves should be used when necessary to prevent skin contact.	
Inhalation		

General Hygiene Considerations and Work Practices

Practice good housekeeping. Do not permit dust to collect on walls, floors, sills, ledges, machinery, or equipment. Maintain, clean and fit test respirator in accordance with regulations. Maintain and test ventilation and dust collection equipment. Wash or vacuum clothing which has become dusty.

Respirator Protection: The following chart specifies the types of respirators which may provide respiratory protection for crystalline silica.

CONDITION Particulate Concentration	**RESPIRATORY PROTECTION FOR CRYSTALLINE SILICA MINIMUM RESPIRATORY PROTECTION***
Up to 5 x PEL	Any dust respirator.
Up to 10 x PEL	Any dust respirator, except single-use or quarter mask respirator. Any fume respirator or high efficiency particulate filter respirator. Any supplied-air respirator. Any self-contained breathing apparatus.
Up to 50 x PEL	A high efficiency particulate filter respirator with a full-face piece. Any supplied-air respirator with a full-face piece, helmet, or hood. Any self-contained breathing apparatus with a full-face piece.
Up to 500 x PEL	A powered air-purifying respirator with a high efficiency particulate filter. A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous-flow mode.

Greater than 500 x PEL or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full-face piece operated in pressure-demand or other positive pressure mode. A combination respirator which includes a Type C supplied-air respirator with a full-face piece operated in pressure-demand or other positive pressure continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
Abrasive Blasting	Any Type CE, supplied-air respirator with a full-face piece, hood, or helmet, operated in a positive-pressure mode. (See 29 CFR Section 1910.94 (a).)

***Only NIOSH-approved equipment should be used. (See 29 CFR Section 1910.134).**

See also ANSI standard Z88.2 (latest version) "Practices for Respiratory Protection."

9. Physical and Chemical Properties

Appearance White or green powder – like material			*Odor*
Normal Physical State: *Liquid* *Gas* *Solid* X		*Boiling Point* *Melting Point* *Freezing Point*	N/A N/A N.A
Specific Gravity or Density (H_20=1) 2.6	*Solubility in Water* 1.5% by weight		*pH* 6 - 8
Vapor Pressure (mm Hg.) N/A	*Vapor Density (AIR = 1)* N/A		*Evaporation Rate (Butyl Acetate=1)*
Other			

10. Stability and Reactivity

Incompatibility (Materials to Avoid)
Contact with powerful oxidizing agents such as fluorine, chlorine, trifluoride, manganese oxide, oxygen difluoride, hydrogen peroxide, etc. may cause fires.

Hazardous Products Produced During Decomposition
When heated to decomposition, it may emit fumes of SO_x.

Hazardous Polymerization?	*May Occur*	*May Not Occur* Y	*Conditions to Avoid* N/A
Stability?	*Stable* Y	*Unstable* N	*Conditions to Avoid* None

11. Toxicological Information

Toxicity Data, Epidemiology Studies, Carcinogenicity, Neurological Effects, Genetic Effects, Reproductive Effects, or Structure Activity Data

Crystalline Silica - Prolonged exposure to respirable crystalline silica may cause delayed (chronic) lung injury (silicosis, pneumoconiosis). Acute or rapidly developing silicosis may occur in a short period of time in heavy exposure in certain occupations such as sandblasters. Silicosis is a form of disabling pulmonary fibrosis which can be progressive and may lead to death. There is evidence that individuals with silicosis may also experience incidences of scleroderma (immune system disorder), tuberculosis, and nephrotoxicity (kidney lesions).

The National Toxicology Program (NTP) published its Ninth Annual Report on Carcinogens which concludes that "silica, crystalline (respirable)" is known to be a human carcinogen. The NTP conclusion is based on sufficient evidence for the carcinogenicity of respirable crystalline silica in experimental animals and limited evidence in humans.

IARC Monographs Volume 68: Silica, silicates, coal dust, and para-aramid fibrils states that there is sufficient evidence in humans for the carcinogenicity of inhaled crystalline silica in the forms of quartz and cristobalite from occupational sources. Crystalline silica is categorized in the "Group 1" category which the IARC defines as the agent in carcinogenic to humans.

Crystalline Silica (quartz) is classified as a substance known to the State of California to be a carcinogen.

Alumino Silicate (Kaolin) – Long-term inhalation of respirable kaolin dusts has caused lung fibrosis (kaolinosis) in experimental animals and workers. In the absence of crystalline silica, it appears that kaolin causes a relative mild fibrosis which generally will not produce pulmonary disease. Kaolinosis can either be simple or complex in nature with complex kaolinosis being associated with respiratory changes and decreased ability of the lungs to provide oxygen.

Fibrous Glass: (Acute) may cause irritation of skin or less frequently eyes, nose and throat (chronic) animal inhalation studies for fiberglass have not shown evidence of a carcinogenic or fibrogenic response. Studies using artificial implantation or injection of glass fibers have resulted in cancer in laboratory animals. However, since there are no natural mechanisms which would mimic such artificial exposure, these studies are not thought to be relevant to human exposure.

12. Ecological Information

Toxicity, Environmental Fate, Physical/Chemical Data, or Other Data Supporting Environmental Hazard Statements

No ecotoxicity data available. This product is not expected to present an environmental hazard.

13. Disposal Considerations

Regulations

Dispose in accordance with national, regional, state, and local regulations.

Properties (Physical/Chemical) Affecting Disposal

14. Transport Information

Regulated for shipping?	*Proper Shipping Name*	*Packing Group*
Yes *No* X	Plaster	N/A
Do changes in quality, packaging, or shipment method change product classification?	*Hazard Class*	*Identification Number*
Yes *No* X	N/A	N/A

Other

15. Regulator Information

Federal Regulations

International Regulations

Other

WARNING:

Contains respirable crystalline silica (RCS). Do not breathe dust. May cause delayed lung injury (silicosis, pneumoconiosis). The IARC (International Agency for Research on Cancer) reports IARC Monograph 68) there is sufficient evidence in humans for the carcinogenicity of inhaled crystalline silica in the forms of quartz and cristobalite from occupational sources. The NTP (National Toxicity Program) reports (Ninth Annual Report on Carcinogens) that RCS is known to be a carcinogen based on sufficient evidence from studies in humans indicating a casual relationship between exposure to RCS increases lung cancer rates in workers exposed to crystalline silica dust. Follow Safety and Health Standards for crystalline silica.

16. Other Information

NFPA Hazard Rating	**Health:** 1	**Flammability:** 0	**Reactivity:** 0
HMIS Hazard Rating	**Health:** 3	**Flammability:** 0	**Reactivity:** 0
	Personal Protection: Use NIOSH/OSHA approved respirator.		

The information set forth herein has been gathered from standard reference materials and/or Ransom & Randolph Company test data and is, to the best knowledge and belief of Ransom & Randolph Company accurate and reliable. Such information is offered solely for your consideration, investigation and verification and it is not suggested or guaranteed that the hazard precautions or procedures mentioned are the only ones which exist. Ransom & Randolph Company makes no warranties, express or implied, with respect to the use of such information or the use of the specific material identifies here in combination with any other material or process, and assumes no responsibility therefore.

TABLE OF OCCUPATIONAL EXPOSURE LIMIT VALUES

The following table shows the Occupational Exposure Limits (OEL) for quartz, cristobalite and tridymite in application in Europe and in some other countries.

Country	Occupational Exposure Limit (OEL) Name	Adopted by	Quartz (q)	Cristobalite (c)	Tridymite (t)
Australia	National Exposure Standard	Worksafe Australia, National Occupational Health & Safety Commission	0.2	0.1	
Austria	Maximalen ArbeitsplatzKoncentration	Bundesministerium für Arbeit und Soziales	0.15	0.15	0.15
Belgium		Ministére de l'Emploi et du Travail	0.1	0.05	0.05
Denmark	Threshold Limit Value	Direktoratet fot Arbeidstilsynet	0.1	0.05	0.05
Finland	Occupational Exposure Standard	National Board of Labour Protection	0.2	0.1	0.1
France	Empoussiérage de reference	Ministére de l'Industrie (RGIE)	5 or 25k/Q		
	Valeur limite de Moyenne d'Exposition	Ministére du Travail	0.1	0.05	0.05
Germany	Maximalen ArbeitsplatzKoncentration	Grenzwerte in der Luft am Arbeitsplatz	0.15	0.15	0.15
Greece		Legislation for mining activities	0.1	0.05	0.05
Ireland		2001 Code of practice for the Safety, Health & Welfare at Work (CoP)	0.05	0.4	0.4
Italy	Threshold Limit Value	Associazone Itallana Degli Igienisti Industriali	0.05	0.05	0.05
Luxembourg	Maximlen ArbeitsplatzKoncentration	Grenzwerte in der Luft am Arbeitsplatz	0.15	0.15	0.15
Netherlands	Maximaal Aanvarde Concentratie	Ministerie van Sociale Zaken en Werkgelegenheid	0.075	0.075	0.075
Norway	Threshold Limit Value	Direktoratet for Arbeidstilsynet	0.1	0.05	0.05
Portugal	Threshold Limit Value	Instituto Portuges da Qualidade, Hygiene & Safety at Workplace	0.1	0.05	0.05
Spain	Valores Limites	Instituto Nacional de Seguridad e Higiene en el Trabajo	0.1		
		Instrucciones de Técnicas Complementarias (ITC)	0.1	0.05	0.05
		Reglamento General de Normas Basicas de Seguridad Minera	5 or 25k/Q		
Sweden		National Board of Occupational Safety and Health	0.1	0.05	0.05
Switzerland	Valeur limite de Moyenne d'Exposition		0.15	0.15	0.15
United Kingdom	Maximum Exposure Limit	Health & Safety Executive	0.3	0.3	0.3
	Occupational Exposure Standard				
USA	Permissible Exposure Limit	Occupational Safety & Health Administration	$10/(\%SiO_2+2)$	PEL (Quartz)/2	PEL (Quartz)/2
	Threshold Limit Value	American Conference of Governmental Industrial Hygienists	0.05	0.05	0.05

Q: quartz percentage
Source: Adapted from IMA-Europe
Date: 08/05/03, Updated version available at http://www.ima-eu.org/en/silhsefacts.html
OELs are applicable to 100 % quartz, cristobalite or tridymite.
Some countries have special rules for mixed dust, e.g. in France the following equation is applied: $C_{ns}/5 + C_q/0.05+C_t/0.05 \leq 1$ (C = mean concentration, ns = non silicogen)