

Ransom & Randolph

1. Product and Company Name

<i>Product Name</i> Astro-Vest™ investment	<i>MSDS Code Number</i> 002
<i>Trade Name & Synonyms</i>	<i>Date of Last Revision</i> 02/03
<i>Chemical Name</i> Silicon Dioxide/Phosphate	<i>Manufacturer</i> Ransom & Randolph
<i>C.A.S. Number</i>	<i>Address</i> 3535 Briarfield Blvd, Maumee, OH 43537
<i>Grades or Minor Variant Identities</i>	<i>Information Telephone Number</i> 419/865-9497 FAX: 419/865-9997
<i>Product Use</i> Investment casting	<i>Emergency Telephone Number</i> 419/865-9497

2. Composition

<u>Hazardous Components</u>	<u>C.A.S. Number</u>	<u>%</u>
Silica (quartz)	14808-60-7	<70
Silica (cristobalite)	14464-46-1	<35
Magnesium Oxide	1309-48-4	<10
Silica (fused)	60676-86-0	<5
Fibrous glass	65997-17-3	<5

3. Hazardous Identification*Emergency Overview*

Astro-Vest™ investment contains crystalline silica. Do not breathe dust. May cause delayed lung injury (silicosis, pneumoconiosis).

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

Medical Conditions Aggravated by Exposure

Any pre-existing respiratory or pulmonary disease or condition, such as, but not limited to, bronchitis, emphysema and asthma. Individuals with silicosis are predisposed to develop tuberculosis.

Carcinogenicity (IARC, NTP)

IARC: Yes

IARC Monograph 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 is carcinogenic to humans.

Fibrous Glass: Continuous filament fiberglass has been designated by IARC as a Group 3, "not classifiable as to human carcinogenicity." This means that evidence is insufficient to link that fiber to cancer.

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.

Potential Environmental Effects

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

4. First Aid Measures

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

Note to Physicians (Treatment, Testing, and Monitoring)

5. Fire-fighting Measures

<i>Flashpoint: (Method)</i> N/A	<i>Flammable (Explosive) Limits in Air</i> LEL: N/A UEL: N/A		<i>Autoignition Temperature:</i> N/A	<i>Other</i> Do not inhale dust. Wear respirator.
<i>Flame Propagation or Burning Rate (for solids):</i> This product will not burn.	<i>Properties Contributing to Fire Intensity</i>	<i>Flammability Classification NFPA Rating:</i> 0		

<i>Extinguishing Media</i> This product is compatible with all extinguishing media. Use any media appropriate for the surrounding fire.	<i>Extinguishing Media to Avoid</i> None
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Protection and Procedures for Firefighters:
Avoid eye and skin contact. Do not breathe fumes.

Unusual Fire and Explosion Hazards:

Contact with powerful oxidizing agents such as fluorine, 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

Dispose in accordance with federal, 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

Astro-Vest investment should always be stored in a dry location and the container should remain sealed as tight as possible when not in use.

Other precautions:

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 8.

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 PEL. See ACGIH "Industrial Ventilation, A Manual 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

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.

Other Protective Measures and Equipment

We recommend that smoking be prohibited in all areas where respirators must be used. See attached table entitled "TABLE OF OCCUPATIONAL EXPOSURE LIMIT VALUES."

OCCUPATIONAL PROTECTION MEASURES

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

<i>Appearance</i> Gray to white powder		<i>Odor</i> None
<i>Normal Physical State:</i> <i>Liquid</i> <i>Gas</i> <i>Solid</i> X <i>Powder</i>		<i>Boiling Point</i> N/A <i>Melting Point</i> N/A <i>Freezing Point</i> N/A
<i>Specific Gravity or Density (H₂O=1)</i> 2.60	<i>Solubility in Water</i> <10.0	<i>Ph</i> N/A

<i>Vapor Pressure (mm Hg.)</i> N/A	<i>Vapor Density (AIR = 1)</i> N/A	<i>Evaporation Rate (Butyl Acetate=1)</i> N/A	
<i>Other</i>			
10. Stability and Reactivity			
<i>Incompatibility (Materials to Avoid)</i> Contact with powerful oxidizing agents such as fluorine, chlorine, trifluoride manganese oxide, oxygen difluoride, hydrogen peroxide, etc. may cause fires.			
<i>Hazardous Products Produced During Decomposition</i> When heated to composition may emit fumes of NO _x , NH ₃ .			
<i>Hazardous Polymerization?</i>	<i>May Occur</i>	<i>May Not Occur</i> X	<i>Conditions to Avoid</i> N/A
<i>Stability?</i>	<i>Stable</i> X	<i>Unstable</i>	<i>Conditions to Avoid</i> None
11. Toxicological Information			
<i>Toxicity Data, Epidemiology Studies, Carcinogenicity, Neurological Effects, Genetic Effects, Reproductive Effects, or Structure Activity Data</i>			
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.			
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Crystalline Silica (quartz) is classified as a substance known to the State of California to be a carcinogen.			
12. Ecological Information			
<i>Toxicity, Environmental Fate, Physical/Chemical Data, or Other Data Supporting Environmental Hazard Statements</i>			
No ecotoxicity data is available. This product is not expected to present an environmental hazard.			

13. Disposal Considerations

Regulations

Dispose in accordance with federal, state, and local regulations.

Properties (Physical/Chemical) Affecting Disposal

14. Transport Information

Regulated for shipping?

Yes No

Proper Shipping Name

Plaster

Packing Group

N/A

Do changes in quality, packaging, or shipment method change product classification?

Yes No

Hazard Class

N/A

Identification Number

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 OSHA Safety and Health Standards for crystalline silica. See Material Safety Data Sheet (MSDS) for details.

16. Other Information

<i>NFPA Hazard Rating</i>	<i>Health:</i> 1	<i>Flammability:</i> 0	<i>Reactivity:</i> 0
<i>HMIS Hazard Rating</i>	<i>Health:</i> 3	<i>Flammability:</i> 0	<i>Reactivity:</i> 0
<i>Personal Protection:</i> Use NIOSH/MSHA/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 Arbeitsplatzkonzentration	Bundesministerium für Arbeit und Soziales	0.15	0.15	0.15
Belgium		Ministère de l'Emploi et du Travail	0.1	0.05	0.05
Denmark	Threshold Limit Value	Direktoratet for Arbejdstilsynet	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	Ministère de l'Industrie (RGIE)	5 or 25k/Q		
	Valeur limite de Moyenne d'Exposition	Ministère du Travail	0.1	0.05	0.05
Germany	Maximalen Arbeitsplatzkonzentration	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	Associazione Italiana Degli Igienisti Industriali	0.05	0.05	0.05
Luxembourg	Maximlen Arbeitsplatzkonzentration	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 Arbejdstilsynet	0.1	0.05	0.05
Portugal	Threshold Limit Value	Instituto Portugues 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)