MATERIAL SAFETY DATA SHEET

SRM Supplier: National Institute of Standards and Technology
Standard Reference Materials Program
Bldg. 202 Rm. 211
Gaithersburg, Maryland 20899

SRM Number: 1878a (Renewals)
MSDS Number: 1878a
SRM Name: Respirable Alpha-Quartz (Quantitative X-ray Power Diffraction Standard)
Date of Issue: March 1993
Date of Revision: 31 August 1999

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SECTION I. MATERIAL IDENTIFICATION

Material Name: Respirable Alpha Quartz (Quantitative X-ray Powder Diffraction Standard)

Description: This SRM consists of a 5 g unit.

Other Designations: Quartz: (silicon dioxide, sand, rose, rose quartz, natural quartz, silicic anhydride, amethyst, silica, agate, flint, chalcedony, silica flour, crystalline silica).

Chemical Formula: SiO_2

CAS Registration: 14808-60-7

DOT Classification: Not hazardous by DOT regulations

Manufacturer/ Supplier: Available from a number of suppliers

SECTION II. HAZARDOUS INGREDIENTS

Hazardous Component	Nominal Concentration	Exposure Limits and Toxicity Data
Alpha Quartz	> 99.9 %	OSHA PELs-TWA: 0.1 mg/m^3 (respirable particulate) .3 mg/m^3 (total particulate)
		ACGIH TLV-TWA: 0.1 mg/m^3 (1999 intended change to 0.05 mg/m^3) (suspected human carcinogen)
		NIOSH REL-TWA: 50 µg/m^3
		Human, Inhalation: TC_{LO}: 16 mppcf if air administered intermittently during 8 h periods over 17.9 years produces pulmonary fibrosis, cough, and difficulty breathing
		Human, Inhalation: LC_{LO}: 300 µg/m^3 administered intermittently over a 10 y period affects the liver
		Rat, Intratracheal: LD_{LO}: 200 mg/kg

SECTION III. PHYSICAL/ CHEMICAL CHARACTERISTICS

Quartz	
Appearance and Odor: An odorless, tasteless, transparent hexagonal crystal	**Specific Gravity:** 2.64 g/mL to 2.66 g/mL
Molecular Weight: 60.09	**Vapor Pressure (at 1732 °C):** 10 mm
Boiling Point: 2230 °C	**Melting Point:** 1610 °C
Solubility in Water: Insoluble	**Solubility in Other Compounds:** Soluble in hydrofluoric acid; very slightly soluble in alkalies and hot concentrated phosphoric acid. Slightly soluble in alcohol. **Insoluble** in most acids and organic solvents

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A **Method Used:** N/A **Autoignition Temperature:** N/A

Flammability Limits in Air (Volume %): UPPER: N/A
LOWER: N/A

Unusual Fire and Explosion Hazards: Upon heating at high temperatures, quartz combines chemically with many metal oxides. Explosions are possible with chlorine trifluoride, oxygen trifluoride, metals, and ozone in the presence of organic materials. Detonation is possible with quartz and xenon hexafluoride.

Extinguishing Media: This material is noncombustible. Use extinguishing media that is appropriate to the surrounding fire.

Special Fire Procedures: Since the fire may produce toxic fumes, wear a self contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION V. REACTIVITY DATA

Stability: **__X__ Stable** **____ Unstable**

Conditions to Avoid: Avoid excessive temperatures and strong oxidizing materials.

Incompatibility (Materials to Avoid): Quartz dissolves readily in hydrofluoric acid creating an exothermic reaction and forming silicon tetrafluoride, a corrosive gas. It reacts violently with powerful oxidizers such as chlorine trifluoride, manganese trifluoride, oxygen difluoride, vinylacetate, and certain other fluorine-containing compounds. It is attacked by strong alkalis and hydrofluoric acid. Possible detonation occurs with xenon hexafluoride.

Hazardous Decomposition or Byproducts: When exposed to high temperatures, amorphous silica can change its crystal structure to form *tridymite* (above 870 °C) or *cristobalite* (above 1470 °C), which have a greater health hazard than quartz.

Hazardous Polymerization: **_____ Will Occur** **__X__ Will Not Occur**

SECTION VI. HEALTH HAZARD DATA

Route of Entry: **__X__ Inhalation** **__X__ Skin** **__X__ Ingestion**

Health Hazards (Acute and Chronic): Immediate exposure to high concentrations may cause physical discomfort of the upper respiratory tract (URT); contact with the skin can cause irritation due to mechanical abrasion of the dermis. Data of acute eye contact is limited to animal studies. Particles of silica in the range of 2 µm to 3 µm introduced into the *corneal stroma* of rabbit eyes cause little reaction. Chronic exposure to the eye shows an abnormally high silicon content in the *cornea* and a gradual decrease in visual acuity due to *corneal opacities* in the *pupillary* area has been reported in foundry workers who developed *pulmonary silicosis*. These same particles introduced into the *anterior chamber* cause an inflammatory reaction in 3 to 5 weeks with the formation of *fibrotic nodules* in

the *iridocorneal angle*. Finely divided silica injected into the *vitreous humor* of the rabbit eyes has caused *necrosis* of the *retina* and *atrophy* of the *choroid*.

The extended inhalation of dusts containing free silica may result in the disabling *pulmonary fibrosis* known as pulmonary *silicosis*. The Committee on Pneumoconiosis of the American Public Health Association defines *silicosis* as "a disease due to the breathing of air containing silica (SiO_2), characterized by generalized fibrotic changes and the development of miliary nodules in both lungs, and clinically by shortness of breath, decreased chest expansion, lessened capacity for work, absence of fever, increased susceptibility to tuberculosis (some or all of which symptoms may be present), and characterized by x-ray findings."

The duration of exposure which is associated with the development of *silicosis* varies widely for different occupations. There is also much variation in individual susceptibility. The action of silica on the lungs results in the production of a diffuse, *nodular fibrosis* in which the *parenchyma* and the *lymphatic system* are involved. The *fibrosis*, to a certain extent, is progressive and may continue to increase for several years after exposure is terminated. Where the pulmonary reserve is sufficiently reduced, shortness of breath is often a symptom of exposure. This is the first and often most common symptom in cases of uncomplicated silicosis. If severe, it may incapacitate the worker for heavy or even light physical exertion. In extreme cases, there may be shortness of breath even while at rest.

Responses to cristobalite appear to be more severe than from quartz, and the *fibrosis* that follows is more progressive than uncomplicated *silicosis*. Studies show that lung cancer occurs more frequently among silicotics (i.e. miners, quarry, foundry, ceramic and granite workers, and stone cutters) than in the general population. While it is still inconclusive at this time, studies indicate that lung cancer may occur.

The effects of ingestion are due to the mechanical action as crystalline silicas are biologically inert.

Signs and Symptoms of Exposure: The most common physical sign of *silicosis* is the limitation of expansion of the chest. Further progress of the disease results in marked fatigue and the total incapacity to work. Chronic exposure by inhalation to high concentrations of finely divided crystalline silica dust, ranging in exposure periods of a few weeks to 4 to 5 years, may cause a rapidly developing *silicosis*, characterized by *pulmonary insufficiency* with severe *dyspnea*, violent coughing, *tachypnea*, weight loss, and *cyanosis* leading to the development of *cor pulmonale* and death within a short period of time. Death can result from cardiac failure or from the destruction of lung tissue, with resultant *anoxia*. There is no fever or other evidence of systemic reaction. Many cases are complicated by respiratory infections. In late stages, the x-ray may show large conglomerate shadows, due to the coalescence of the silicotic nodules, with an area of *emphysema* between them.

Medical Conditions Generally Aggravated by Exposure: N/A

Listed as a Carcinogen/Potential Carcinogen:

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens	X *	
In the International Agency for Research on Cancer (IARC) Monographs	X**	
By the Occupational Safety and Health Administration (OSHA)		X

* NTP classifies this material as reasonably anticipated to be a human carcinogen [*silica, crystalline* (respirable size)].
** IARC classified this material as Group I: Carcinogenic to Humans.

EMERGENCY AND FIRST AID PROCEDURES:

Skin Contact: Remove contaminated shoes and clothing. Rinse affected area with large amounts of water followed by washing the area with soap and water. Obtain medical assistance if necessary.

Eye Contact: Immediately flush eyes, including under the eyelids, with copious amounts of water for at least 15 min. Obtain medical assistance if necessary.

Inhalation: If inhaled, remove the victim to fresh air. If breathing is difficult, give oxygen; if victim is not breathing, give artificial respiration. Obtain medical assistance if necessary.

Ingestion: If ingested, wash out mouth with water. Obtain medical assistance.

TARGET ORGAN(S) OF ATTACK: Skin, eyes, and URT

SECTION VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken in Case Material Is Released or Spilled: Notify safety personnel of major spills and/or leaks. Provide adequate ventilation. Cleanup personnel need protection against eye and skin contact and dust inhalation. Use dustless systems for cleanup so that airborne dust does not exceed the PEL. Do not dry sweep. Carefully clean up spills without generating dust clouds and place waste in suitable containers for disposal.

Waste Disposal: Contact a licensed contractor for detailed recommendations. Follow all federal, state, and local regulations.

Handling and Storage: Wear protective eyeglasses or chemical safety goggles. Use gloves, aprons, and other protective clothing to prevent skin contact. Protect the skin with barrier creams. Wear a National Institute for Occupational Safety and Health (NIOSH) certified respirator for exposures above the TLV. The specific respirator selected must be based on contamination levels found in the workplace, must not exceed the working limits of the respirator, and must be approved by NIOSH.

Quartz	
Concentration in Workplace (mg/m^3)	**Type of Respirator***
0.25	N-95 or higher (if no oil in work environment)
0.5	Air purifying respirator with a high efficiency particulate filter
1.25	Any powered, air purifying respirator with a high efficiency particulate filter Supplied air respirator with continuous flow mode
2.5	Air purifying, full facepiece respirator with a high efficiency particulate filter Any powered, air purifying respirator with a tight fitting facepiece and a high efficiency particulate filter
25	Supplied air respirator with pressure-demand or other positive-pressure mode
>25	Any SCBA that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode Any supplied air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary SCBA operated in a pressure-demand or other positive-pressure mode

* NIOSH [1997]. NIOSH pocket guide to chemical hazards, Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 97-140.

NOTE: Contact lenses pose a special problem; soft lenses may absorb irritants and all lenses concentrate them. **DO NOT** wear contact lenses in the lab.

Store material in a well ventilated area. Keep material dry and protect containers from physical damage.

SECTION VIII. SOURCE DATA/ OTHER COMMENTS

Sources: MDL Information Systems, MSDS *Quartz*, June 2, 1999.

Disclaimer: Physical and chemical data contained in this MSDS are provided for use in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references; however, NIST does not certify the data on the MSDS. The certified values for this material are given only on the NIST Certificate of Analysis.