Silica, Crystalline (Respirable Size)

CAS No.: none assigned

Known to be a human carcinogen

First listed in the *Sixth Annual Report on Carcinogens* (1991)

Also known as crystalline silicon dioxide

Carcinogenicity

Respirable crystalline silica, primarily quartz dusts occurring in industrial and occupational settings, is *known to be a human carcinogen* based on sufficient evidence of carcinogenicity from studies in humans. Respirable crystalline silica was first listed in the *Sixth Annual Report on Carcinogens* in 1991 as *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity from studies in experimental animals; the listing was revised to *known to be a human carcinogen* in the *Ninth Report on Carcinogens* in 2000.

Cancer Studies in Humans

Exposure of workers to respirable crystalline silica is associated with elevated rates of lung cancer. The link between human lung cancer and exposure to respirable crystalline silica was strongest in studies of quarry and granite workers and workers involved in ceramic, pottery, refractory brick, and diatomaceous earth industries. Human cancer risks are associated with exposure to respirable quartz and cristobalite but not to amorphous silica. The overall relative risk is approximately 1.3 to 1.5, with higher risks found in groups with greater exposure or longer time since first exposure. Silicosis, a marker for exposure to silica dust, is associated with elevated lung cancer rates, with relative risks of 2.0 to 4.0. Elevated risks have been seen in studies that accounted for smoking or asbestos exposure, and confounding by co-exposure is unlikely to explain these results (IARC 1997).

Cancer Studies in Experimental Animals

In rats, exposure to various forms of respirable crystalline silica by inhalation or intratracheal instillation consistently caused lung cancer (adenocarcinoma or squamous-cell carcinoma). Single intrapleural or intraperitoneal injections of various forms of respirable crystalline silica also caused lymphoma in rats (IARC 1997).

Studies on Mechanisms of Carcinogenesis

Respirable crystalline silica deposited in the lungs causes epithelial injury and macrophage activation, leading to inflammatory responses and proliferation of the epithelial and interstitial cells. In humans, respirable crystalline silica persists in the lungs, culminating in the development of chronic silicosis, emphysema, obstructive airway disease, and lymph-node fibrosis. Respirable crystalline silica stimulates (1) release of cytokines and growth factors from macrophages and epithelial cells, (2) release of reactive oxygen and nitrogen intermediates, and (3) oxidative stress in the lungs. All of these pathways contribute to lung disease. Marked and persistent inflammation, specifically inflammatory-cell-derived oxidants, may provide a mechanism by which respirable crystalline silica exposure can result in genetic damage in the lung parenchyma. In one study, human subjects exposed to respirable crystalline silica showed increases in sister chromatid exchange and chromosomal aberrations in peripheral blood lymphocytes. Most cellular genotoxicity studies with quartz gave negative results; however, *in vitro* exposure to some quartz samples caused micronucleus formation or cell transformation in several cell types, including Syrian hamster embryo cells, Chinese hamster lung cells, and human embryonic lung cells (IARC 1997).

Properties

Silica (SiO_2) is a group IV metal oxide that exists as colorless or white trigonal crystals and has a molecular weight of 60.1. It occurs naturally in crystalline and amorphous forms, and the specific gravity and melting point both depend on the crystalline form. The basic structural units of the silica mineral are silicon tetrahedra (SiO_4). Slight variations in the orientation of the tetrahedra result in the different polymorphs of silica; crystalline silica has seven polymorphs. In crystalline silica, silicon and oxygen atoms are arranged in definite regular patterns throughout (Parmeggiani 1983).

Quartz, cristobalite, and tridymite are the three most common crystalline forms of free silica (USBM 1992). Quartz is by far the most common; it is found abundantly in most rock types, including granites and quartzites, and in sands and soils. Cristobalite and tridymite are found in volcanic rocks. All three forms are interrelated and may change their form under different temperature and pressure conditions. The structure of quartz is more compact than that of tridymite or cristobalite (IARC 1987, 1997). Quartz melts to a glass, and its coefficient of expansion by heat is the lowest of any known substance. Silica is practically insoluble in water at 20°C and in most acids; but its solubility increases with temperature and pH and is affected by the presence of trace metals. The rate of solubility also is affected by particle size, and the external amorphous layer in quartz is more soluble than the crystalline underlying core. Silica dissolves readily in hydrofluoric acid, producing silicon tetrafluoride gas (Merck 1989, IARC 1997).

Use

Because of its unique physical and chemical properties, crystalline silica has many uses. Commercially produced silica products include quartzite, tripoli, ganister, chert, and novaculite. Crystalline silica also occurs in nature as agate, amethyst, chalcedony, cristobalite, flint, quartz, tridymite, and, in its most common form, sand (IARC 1997). Naturally occurring silica materials are classified by end use or industry. Sand and gravel are produced almost exclusively for road building and concrete construction, depending on particle size and shape, surface texture, and porosity (IARC 1987).

Silica sand deposits, commonly quartz or derived from quartz, typically have a silica content of 95%; however, impurities may be present at up to 25%. Silica sand has been used for many different purposes over many years. In some instances, grinding of sand or gravel is required, increasing the levels of dust containing respirable crystalline silica. Sand with low iron content and more than 98% silica is used in the manufacture of glass and ceramics. Silica sand also is used in foundry castings, in abrasives (such as sandpaper and grinding and polishing agents), in sandblasting materials, in hydraulic fracturing to increase rock permeability to increase oil and gas recovery, as a raw material for the production of silicon and ferrosilicon metals, and as a filter for large volumes of water, such as in municipal water and sewage treatment plants (IARC 1997).

Extremely fine grades of silica sand products are known as flours. Silica flour, not always labeled as containing crystalline silica and often mislabeled as amorphous silica, is used industrially as abrasive cleaners and inert fillers. Silica flour may be used in toothpaste, scouring powders, metal polishes, paints, rubber, paper, plastics, wood fillers, cements, road surfacing materials, and foundry applications (NIOSH 1981). Cristobalite is a major component of refractory silica bricks; the high temperatures at which the bricks are fired convert the quartz mainly to cristobalite (IARC 1997).

FAQ - frequently asked questions

Diatomaceous Earth

(1) What is diatomaceous earth?
Diatomaceous earth (DE) is a type of rock composed of the silica-containing skeletons of fossilized diatoms (very small marine and freshwater organisms). Silica (silicon dioxide) is a mineral that occurs naturally in crystalline and amorphous (non-crystalline) forms. Diatom skeletons are composed mainly of amorphous silica, with small amounts of quartz and cristobalite. Quartz, cristobalite, and tridymite are three crystalline forms of silica, of which quartz is the most common. Cristobalite occurs naturally in volcanic rock, and is often found with quartz in the Pacific Northwest. It can also be formed by heating ("calcined") DE to a high temperature (1000-1100 °C). DE is mined for use in industrial filtration applications. Its oldest and best-known commercial use is as a very mild abrasive in metal polishes and in toothpaste. It is also used as an anti-caking additive in various food items. Large deposits occur in California, Nevada, Washington, and Oregon.

(2) Is diatomaceous earth hazardous to my health?
DE in its natural state is composed largely of amorphous silica and there is no evidence that this form of silica is particularly toxic to humans. There is also no evidence to associate any form of natural DE with cancer in either experimental animals or humans. It does contain small amounts of crystalline silica, mainly cristobalite, which is the form of silica that can pose a health hazard. However, the amount of crystalline silica in natural DE is too small to pose a health hazard.

(3) Could inhaling diatomaceous earth be a health hazard?
Inhaling naturally-occurring DE should pose no more of a health hazard than inhaling dust in general. Whether dust, including DE dust, could cause harm depends on how much of it is "respirable" (i.e., is of the right size to be taken into the lungs), how much of it is in the air (i.e., its air concentration), and how long a person is exposed to (breathes) it. For most people, breathing dust is likely to be no more than an unpleasant nuisance. However, for people with health problems (e.g., asthmatics, the elderly), those who breathe more (e.g., children) or breathe other chemicals (e.g., smokers), exposure to respirable dust at moderate to high concentrations could cause or worsen health problems.

(4) What is it in diatomaceous earth that may cause a health hazard?
Respirable crystalline silica (mainly cristobalite) is the form of silica that can pose a health hazard. While the amount of crystalline silica in natural DE is too small (0.4 - 1.1%) to pose a health hazard, heating DE to high temperatures changes much of the harmless amorphous silica into the potentially harmful crystalline form. Processed (calcined) DE may contain from 20% to 60% crystalline silica.

(5) Is processed diatomaceous earth potentially more hazardous to your health than the naturally-occurring form?
Yes, because processed (calcined) DE may contain far greater amounts of crystalline silica, the potentially harmful form of silica, than natural DE. Crystalline silica is likely to pose health hazard only if inhaled at high levels for a long time.

(6) Can silica cause silicosis or cancer?
Yes, but only for crystalline silica and probably only under work-related conditions. Inhalation of crystalline silica under occupational conditions can produce a severe and disabling non-cancer disease of the lungs ("silicosis"). Silicosis can be either mild or severe, in direct proportion to the percentage and concentration of crystalline silica in the air and the duration of exposure. Silicosis is typically a work-related disease that develops over years of exposure to very high levels of crystalline silica-containing dust. Crystalline silica is presently considered a known human carcinogen only under occupational conditions. Health problems from crystalline silica are associated with exposure to very high levels for long periods (years), conditions that are unlikely to occur in non-industrial or residential situations.

(7) How do we measure exposure?
The amount of dust (or of any chemical) in the air is usually expressed as a concentration, typically milligrams of dust per cubic meter of air, or mg/m^3. When measuring dust concentrations, respirable and total amounts are measured separately. Total is all the dust. Respirable includes only those particles small enough (about 3.5 microns in diameter [a human hair is 60-100 microns in diameter]) to enter deep into the human lung. Respirable is measured separately because it is the more hazardous form of dust. In Oregon, the amount of crystalline silica in an air sample is the sum of

DEQ
State of Oregon
Department of Environmental Quality

Air Quality Division
811 SW 6th Avenue
Portland, OR 97204
Phone: (503) 229-6251
(800) 452-4011
Fax: (503) 229-5850
Contact: Bruce Hope
www.oregon.gov/DEQ/

Last Updated: 09/14/11
By: Bruce Hope
DEQ 08-AQ-004

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*                  C H E M I N F O                    *
*                                                     *
* Canadian Centre for Occupational Health and Safety  *
* * * * * * * * * * * Issue : 2001-1 (February, 2001) *

     *** SECTION 1.   CHEMICAL IDENTIFICATION ***

CHEMINFO RECORD NUMBER          : 757
CCOHS CHEMICAL NAME             : Diatomaceous earth, calcined
SYNONYMS :
   * Calcined diatomaceous earth
   * Calcined diatomite
   * Calcined kieselguhr
   * Celite
   * Diatomaceous earth, flux calcined
   * Diatomite, calcined
   * Diatomite, flux calcined
   * Flux calcined diatomaceous earth
   * Flux calcined diatomite
   * Flux calcined kieselguhr
   * Kieselguhr, calcined
   * Kieselguhr, flux calcined
   * Diatomaceous earth (non-specific name)
CAS REGISTRY NUMBER             : 91053-39-3
OTHER CAS REGISTRY NUMBER(S)    : 68855-54-9
CHEMICAL FAMILY                 : Silicon and compounds / inorganic silicon compound / microcrystalline
MOLECULAR FORMULA               : O2Si
STRUCTURAL FORMULA              : Unknown or variable composition.

   STATUS :
      The CHEMINFO record for this chemical is complete.  The full format
      ("TOTAL") provides a detailed evaluation of health, fire and
      reactivity hazards, as well as recommendations on topics such as
      handling and storage, personal protective equipment, accidental
      release and first aid.

                    *** SECTION 2.   DESCRIPTION ***

APPEARANCE AND ODOUR :
White crystals, powder or granules (flux-calcined); pink or yellowish to
dark brown powder or granules (calcined) (20,21)
ODOUR THRESHOLD :
   Odourless
WARNING PROPERTIES :
   POOR - odourless; short-term irritation effects may be mild.
COMPOSITION/PURITY :
   Diatomaceous earth or diatomite is a naturally occurring, porous, high
   surface area form of hydrous silica.  Diatomaceous earth products are
   classified according to the manufacturing method.  They are divided into
   three categories: natural or uncalcined diatomaceous earth (CAS Registry
   No. 61790-53-2), calcined diatomaceous earth (CAS Registry No. 91053-39-3),
   and flux-calcined diatomaceous earth (CAS Registry No. 68855-54-9).(20)
   This record provides information for calcined and flux-calcined
   diatomaceous earth.  Calcined diatomaceous earth is produced from natural
   diatomaceous earth, which is subjected to high temperature calcination at
   800-1000 deg C and can contain up to 25% cristobalite.  Flux-calcined
   diatomaceous earth is obtained from the natural product in the presence of
   a fluxing agent, generally soda ash (sodium carbonate) at 1000-2000 deg C.
   The flux-calcined product can contain up to 65% cristobalite.  Small
   amounts of quartz and tridymite may also be present in both
   products.(12,20,21)  These are all forms of crystalline silica with well
   recognized health hazards.  The amount of crystalline silica in calcined
   and flux-calcined diatomaceous earth depends upon the time and temperature
   and the method of calcining.  Small amounts of impurities, such as alumina,
   ferric oxide and sodium, potassium and calcium oxides may be present.(21)
   Refer also to CHEMINFO records 79, 288, and 289 for detailed information on
   quartz, cristobalite and tridymite respectively.  Refer to CHEMINFO record
   760 for information on natural or uncalcined diatomaceous earth.
USES AND OCCURRENCES :
   Calcined or flux-calcined diatomaceous earth is used as a filtration agent;
   and as a functional filler in paints, plastics, rubber, adhesives,
   catalysts, agricultural chemicals, pharmaceuticals, toothpastes, polishes
   and other chemicals.  Also used as a thermal insulator and
   absorbent.(20,21)

                  *** SECTION 3.   HAZARDS IDENTIFICATION ***

                          ** EMERGENCY OVERVIEW **

   White crystals, powder or granules (flux-calcined) or pink or yellowish to
   dark brown powder or granules (calcined).  Odourless.  Will not burn.
   CANCER HAZARD - may cause cancer, based on the amount of cristobalite and
   quartz present.
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** POTENTIAL HEALTH EFFECTS **

EFFECTS OF SHORT-TERM (ACUTE) EXPOSURE :

INHALATION :

In general, high concentrations of dust may cause coughing and mild, temporary irritation. There is no specific human information available about the short-term inhalation effects of calcined or flux-calcined diatomaceous earth or cristobalite.

However, calcined and flux-calcined diatomaceous earth can have potentially serious respiratory effects following long-term inhalation (one year or more). One animal study indicates that serious respiratory effects may even develop after short-term (8-days) exposure to high concentrations (30-81 mg/m3) of cristobalite (see CHEMINFO 288 for details). Refer to "Effects of Long-Term (Chronic) Exposure" below.

SKIN CONTACT :

In general, calcined and flux-calcined diatomaceous earth is not expected to be irritating to the skin. Foreign-body reactions (granulomas) have been observed after crystalline silica was accidentally introduced under the skin as a result of injury. Often the effects are delayed for periods ranging from weeks up to more than 50 years.(1) Since both calcined and flux- calcined diatomaceous earth contains crystalline silica, they will likely cause the same type of effect.

EYE CONTACT :

In general, the dust is probably irritating as a "foreign substance". Some tearing, blinking and mild, temporary pain may occur as the solid material is rinsed from the eye by tears. There is no human or animal information available.

INGESTION :

There is no human or animal information available for calcined or flux-calcined diatomaceous earth. These materials are probably not toxic following short-term ingestion. Ingestion is not a typical route of occupational exposure for this material.

EFFECTS OF LONG-TERM (CHRONIC) EXPOSURE :

INHALATION: Prolonged or repeated exposure to fine airborne crystalline silica dust may cause severe scarring of the lungs, a disease called silicosis. The risk of developing silicosis depends on the airborne concentration of respirable-size crystalline silica dust to which an employee is exposed (see Sampling and Analysis section) and duration of exposure. Particles with diameters less than 1 micrometre and freshly cleaved particles are considered most hazardous.(2,3) Silicosis usually develops gradually over 20 years or more of exposure.(4) Several reliable studies have found silicosis in employees with exposure to considerably less than 1 mg/m3 respirable quartz.(1,5) Evidence indicates that cristobalite, a major component of calcined and flux-calcined diatomaceous earth, causes more severe injury to the lungs than quartz.

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A number of studies have observed X-ray evidence of scarring of the lungs (silicosis/progressive fibrosis) in employees in the diatomaceous earth mining and processing industry, exposed to both calcined and uncalcined diatomaceous earth.(6,7,8,9) These effects were generally attributed to the cristobalite content of the dust. Other cases of advanced silicosis and silicosis with tuberculosis have been observed in workers occupationally exposed to a airborne dust containing 80% calcined diatomaceous earth (in the manufacturing of filter candles) for more than 1 year.(10) The long-term health hazard associated with diatomaceous earth is mainly dependent on its cristobalite content.

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The early symptoms of silicosis, cough, mucous production and shortness of breath upon exertion, are non-specific, so the development of silicosis may not be detected until advanced stages of the disease. Silicosis may continue to develop even after exposure to crystalline silica has stopped. Evidence of silicosis can normally be seen on an X-ray.(2,11)

.

Silicosis can vary in severity from minimal to severe. In cases of mild silicosis, there is typically no significant respiratory impairment, although there is X-ray evidence of lung injury. In severe cases, significant and increasingly severe respiratory impairment develops. There is no proven effective treatment for the disease.(4) Life expectancy may be reduced, depending on the severity of the case. Death is not usually a direct result of silicosis, but cardiac failure (cor pulmonale) may occur as the heart has increasing difficulty pumping blood through the scar tissue in the lungs. Silicosis may be complicated by the development of bacterial infections, including tuberculosis.(2,4)

.

"Accelerated" silicosis results from exposure to high concentrations of crystalline silicas over a period of 5 to 10 years. The disease continues to develop even after exposure stops and is often associated with autoimmune diseases, for example, scleroderma (a skin disease involving thickening of the skin).(4)

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"Acute" silicosis (also referred to as "silicotic alveolar proteinosis") is rare in humans, but can develop if very high concentrations of crystalline silica dust are inhaled over a relatively short period of time (1-2 years) and has occurred in occupations such as sandblasting or tunnelling where

exposure controls were minimal. Acute silicosis may result in death within a few years, often with tuberculosis as a complication.(2)

CARCINOGENICITY :

Calcined and flux-calcined diatomaceous earth contain varying amounts of crystalline silica in the form of cristobalite, and may also contain small amounts of quartz. The International Agency for Research on Cancer (IARC) has concluded that inhaled crystalline silica in the form of cristobalite or quartz from occupational sources is carcinogenic to humans (Group 1).(27) The cancer hazard of calcined or flux-calcined diatomaceous earth depends upon the concentration of cristobalite and quartz present.

Recent reviews have tended to conclude that if silica exposures are controlled to prevent silicosis, they will also probably prevent lung cancer.(1,5) The risk of silicosis depends upon the concentration of dust, the particle size and the duration of exposure.

The American Conference of Governmental Industrial Hygienists (ACGIH) has no listing for calcined diatomaceous earth. ACGIH has not assigned a carcinogenicity designation to cristobalite or tridymite. Quartz has been listed as an A2 (suspected human carcinogen).

The US National Toxicology Program (NTP) identifies crystalline silica (respirable size) as a known human carcinogen.(15)

TERATOGENICITY AND EMBRYOTOXICITY :

There is no human or animal information available.

REPRODUCTIVE TOXICITY :

There is no human or animal information available.

MUTAGENICITY :

There is no human or animal information available. Cristobalite, a major component of calcined and flux-calcined diatomaceous earth, was mutagenic (DNA double strand breaks) in one in vitro test.(1,unconfirmed)

TOXICOLOGICALLY SYNERGISTIC MATERIALS :

There is disagreement about whether tobacco smoke increases the severity of the effect of crystalline silica dust on respiratory impairment.(1,12,16) Simultaneous exposure to known carcinogens, for example, benzo(a)pyrene, can increase the carcinogenicity of crystalline silica.(11) A synergistic effect between smoking and crystalline silica and/or silicosis on risk of lung cancer, is also likely.(5).

POTENTIAL FOR ACCUMULATION :

Calcined and flux-calcined diatomaceous earth probably does not accumulate in the body. Inhaled silica particles are deposited at various locations within the respiratory tract, depending on their shape, mass, aerodynamic characteristics and other physical properties. Most, but not all silica is cleared from the lungs after inhalation and deposition. The elimination of particles continues for many years after the last exposure.(5) Silica is slightly absorbed into the body. Absorbed silica is deposited mainly in the liver, spleen and regional lymph nodes. Silicic acid absorbed into the blood stream is excreted through the kidneys.(1)

*** SECTION 4. FIRST AID MEASURES ***

INHALATION :

Suspect cancer hazard. If high airborne concentrations are present, take proper precautions to ensure your own safety before attempting rescue (e.g. wear appropriate protective equipment). If symptoms are experienced, remove source of contamination or have victim move to fresh air. Obtain medical advice.

SKIN CONTACT :

No health effects expected. If irritation does occur, flush with lukewarm, gently flowing water for 5 minutes or until the chemical is removed.

EYE CONTACT :

Do not allow victim to rub eye(s). Let the eye(s) water naturally for a few minutes. Have victim look right and left, and then up and down. If particle/dust does not dislodge, flush with lukewarm, gently flowing water for 5 minutes or until particle/dust is removed, while holding the eyelid(s) open. If irritation persists, obtain medical attention. DO NOT attempt to manually remove anything stuck to the eye(s).

INGESTION :

No health effects expected. If irritation or discomfort occur, obtain medical advice.

FIRST AID COMMENTS :

All first aid procedures should be periodically reviewed by a doctor familiar with the material and its condition of use in the workplace.

NOTE TO PHYSICIANS :

Jurisdictions which have specific regulations for crystalline silica also require medical surveillance programs.

Medical surveillance programs may include periodic physical examinations, chest X-rays and pulmonary function tests.

Since there may be some variation in these requirements, specific information should be sought from the appropriate government agency in each jurisdiction.

*** SECTION 5. FIRE FIGHTING MEASURES ***

FLASH POINT :

Not combustible (does not burn) (15)

LOWER FLAMMABLE (EXPLOSIVE) LIMIT (LFL/LEL) :

Not applicable

DIGITALFIRE REFERENCE DATABASE

Digitalfire Hazards Database

Alumina Toxicology
Ammonia and Latex Toxicity
Antimony Oxide
Arsenic Oxide
Asbestos: A Difficult-to-Repace Material
Ball Clay
BARIUM and COMPOUNDS / Toxicology
Barium in Materials and Fired Glazes
Bentonite Toxicity
Beryllium Monoxide Toxicology
Bismuth Trioxide Toxicology
Boron Compounds and Their Toxicity
Brown Stain
Cadmium: Prevention/Screening Strategy
Calcium Carbonate Toxicology
Carbon Monoxide Toxicity
Cesium Toxicology
Chromium Compounds Toxicology
Cobalt Oxide and Carbonate
Cobalt Toxicology
Copolymer Latex Precautions
Copper Compounds Toxicology
Copper Oxide and Carbonate
Cristobalite Toxicity
Cryolite and Ceramics
Dealing With Dust in Ceramics
Diatomaceous Earth Toxicology
Dioxins in Clays
Epsom Salts
Eye Injuries Due to Radiation
Feldspar
Fighting Micro-organisms in Ceramics
Fluorine Gas
Gallium Oxide Toxicology
Hafnium Oxide Toxicty
Hydrofluoric Acid Toxicity
Iron oxide and Hematite
Kaolin
Lead and Ceramics
Lead Chromate
Lead in Ceramic Glazes: What Did We Learn?
Lead in Frits: The Hazards
Lithium Carbonate Toxicity
Lithium in Ceramics
Man-Made Vitreous Vibers
Manganese and Parkinsons by Jane Watkins
Manganese in Clay Bodies
Manganese Inorganic Compounds Toxicology
Manganese Toxicity by Elke Blodgett
Manganese: Creativity and Illness by Dierdre O'Reilly
Molybdenum Compounds Toxicology
New Record
Nickel Compounds Toxicity
Niobium Oxide Toxicity
Occupational Dermatoses
Overview of Material Safety by Gavin Stairs
Paraffin Toxicology
Perlite
Plant Ash Toxicity
Poly Rubber
Potassium Carbonate Toxicity
Pregnancy and Ceramics
Propane Toxicology
Quartz Toxicity on Clayart
Quartz, Crystalline Silica Toxicity
Rare Earth Compounds Toxicity
Refractory Ceramic Fibers
Rubidium and Cesium Toxicology
Rutile Toxicology

Diatomaceous Earth Toxicology

Synonyms :

Diatomite, diatomaceous silica, infusorial earth.

Uses :

In the production of filters, polishes, absorbents, insulators.

Toxicity :

Amorphous silica, natural diatomaceous earth, is usually considered to be of low toxicity; however, pure amorphous silica is rarely found. Depending on the source, it may contain a low percentage of contaminating quartz, rarely over 2%; characteristically, natural diatomite contains no measurable cristobalite. Processing of amorphous silica by high-temperature calcining, with or without the concomitant use of fluxing agents, alters the silica from the benign amorphous to the pathogenic form (cristobalite), which causes lung fibrosis. Non-flux-calcined diatomite may contain from 20% to 30% cristobalite, flux-calcined diatomite may contain as much as 60% cristobalite. Calcined diatomite can produce a severe and disabling pneumoconiose, which is attributed to its cristobalite content. Altough a form of silicosis, it characteristically produces pathologic and radiographic changes, which are different from classical quartz silicosis. Diffuse rather than nodular changes are more common. There is no evidence to associate any form of diatomaceous earth with human cancer.
The IARC concluded that evidence is inadequate to

Silicosis and Screening
Silver Compounds Toxicology
Sodium Azide Toxicology
Sodium Carbonate Toxicology
Sodium Silicate Powder Toxicology
Stannous Chloride Toxicity
Strontium Carbonate Toxicity Note
Sulfur Dioxide Toxicity
Talc Hazards Overview
Talc Toxicology
Thallium Oxide Toxicology
The Use of Barium in Clay Bodies
Thorium Dioxide Toxicity
Tin and Inorganic Compounds
Titanium Dioxide
Tungsten Compounds Toxicology
Understanding Acronyms on MSDS's
Uranium and Ceramics
Uranium Salts
Vanadium and Compounds Toxicology
Zeolite
Zinc Compounds
Zirconium Compounds Toxicity
Zirconium Encapsulated Stains

describe amorphous silica as carcinogenic in either experimental animals or humans. The IARC concluded that crystalline silica is a probable human carcinogen.

Quebec's exposure limit :

VEMP (Valeur d'Exposition Moyenne Pondérée) =3D 6mg/m³ (Total dust), if the crystalline silica content is < 1%

References :
1-Occupational Medicine,Carl Zenz, last edition.
2-Clinical Environmental Health and Toxic Exposures, Sullivan & Krieger; last edition.
3-Sax's Dangerous Properties of Industrial Materials, Lewis C., last edition.
4-Toxicologie Industrielle et Intoxications Professionnelles, Lauwerys R.R. last edition.
5-Chemical Hazards of the Workplace, Proctor & Hughes, 4th edition

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Out Bound Links

- (Typecodes) 12: EBA - Article by Edouard Bastarache

In Bound Links

- (Materials - Lung damage) Diatomaceous Earth
  Diatomite

Feedback, Suggestions

Your email address

Subject

Feedback at ceramic_hazard_diatomaceous_earth_toxicology_351.html

Your Name

Message

MATERIAL SAFETY DATA SHEET

Identity:
Sepiolite Clay (CAS #63800-37-3)

Section I

Manufacturer's Name
IMV Nevada

Emergency Telephone Number
800-243-0513
775-372-5341

Address:
HC 70 Box 549
498 E. Imvite Rd.
Amargosa Valley, Nevada 89020

Telephone Number for Information
775-372-5341

Date Prepared: 09/08/04
Date Revised: 06/01/12

SECTION II –HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

Hazardous Components: Respirable dust may contain Silica, Crystalline Quartz (CAS #14808-60-7)

Specific Chemical Identity:

Sepiolite: $H_6Mg_8Si_{12}O_{30}$ OH_{10} 6 H_2O CAS #63800-37-3

Common Names: Sepiolite, Meershaum, Palygorsite, Clay, a natural mineral extracted from the earth (see trade names, page 5)

OSHA PEL: Classified as a nuisance dust when less than 1% crystalline silica is present, PEL = 5.00 mg/M^3 (respirable)

If greater than 1% crystalline silica, then exposures shall not exceed an 8 hr. time weighted average limit as stated in 29 CFR 1910.1000 Table Z-1-A for air contaminants, specifically:

Silica, Crystalline Quartz (respirable 0.1 mg/M^3

ACGIH TLV: Classified as a nuisance dust when less than 1% crystalline silica, TLV-TWA = 10 mg/M^3 (total dust), 5 mg/M^3 (Respirable)

If greater than 1% crystalline silica, the TLV-TWA = 0.1mg/M^3 (respirable crystalline quartz). The Threshold Limit Value and Biological Exposure Indices for 1991-1992, American Conference of Governmental Industrial Hygienists.

Other Limits Recommended: National Institute for Occupational Safety and Health (NIOSH). Recommended standard maximum permissible concentration= 0.05 mg/M^3 (respirable crystalline quartz) as determined by a full-shift sample up to 10-hour working day, 40 hour work week. See NIOSH Criteria for Recommended Standard Occupational Exposure to Crystalline Silica.

SECTION III –PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point: More than 1000°F **Specific Gravity** (H_2O=1) 1.9-2.4

Vapor Pressure (mm Hg.): None **Melting Point:** None

Vapor Density (AIR=1) None **Evaporation Rate:** None

Solubility in Water: Insoluble in water

Appearance and Odor: Light gray, tan or reddish tan, granular or powder. Earthy odor when wet.

SECTION IV –FIRE AND EXPLOSION HAZARD DATA

Flash Point (method used): non-flammable
Flammable Limits: None **LEL:** None **UEL:** None
Extinguishing Media: None Required
Special Fire Fighting Procedures: None
Unusual Fire and Explosion Hazards: None

SECTION V -- REACTIVITY DATA

Stability: Stable **Conditions to Avoid:** None
Incompatibility (Materials to Avoid): None
Hazardous Decomposition or Byproducts: None
Hazardous Polymerization: Will Not Occur

SECTION VI – HEALTH HAZARD DATA

Route(s) of Entry: Inhalation? Yes Skin? No Ingestion? No

Health Hazards (Acute and Chronic)
May be harmful if inhaled in sufficient quantities. Prolonged exposure to Sepiolite Clay dust may cause a relatively benign lung disease, though there is a risk of massive fibrosis. Repeated and prolonged exposure to respirable crystalline quartz which may be contained in Sepiolite Clay dust may cause delayed (chronic) lung injury silicosis. Silicosis is a form of disabling pulmonary fibrosis which can be progressive and may lead to death.

Carcinogenicity: NTP? Yes IARC Monographs? Yes OSHA Regulated? Yes

IARC has reported that there is inadequate evidence for the carcinogenicity of Sepiolite in experimental animals and that there is no date available to evaluate the carcinogenicity of Sepiolite in humans (IARC Class 3).

Sepiolite Clay, like other naturally occurring minerals, may contain crystalline silica. ARC has concluded that there is limited evidence for the carcinogenicity of crystalline silica to humans and sufficient evidence of carcinogenicity of crystalline silica in experimental animals (IARC Class 2A). The NTP has concluded that "silica: Crystalline (respirable)" may reasonably be anticipated to be a carcinogen, based upon evidence for the carcinogenicity of respirable crystalline silica in experimental animals and limited evidence in humans.

Signs and Symptoms of Exposure: undue breathlessness, wheezing, cough and sputum products.

SECTION VI- CONTINUED

Medical Conditions Generally Aggravated by Exposure: Pulmonary function may be reduced by inhalation of respirable crystalline silica that may be in Sepiolite Clay, dust lung scarring produced by such inhalation may lead to progressive massive fibrosis of the lung which may aggravate other pulmonary conditions and diseases and which increases the susceptibility to pulmonary tuberculosis. Progressive massive fibrosis may be accompanied by right heart enlargement, heart failure and pulmonary failure. Smoking aggravates the effects of exposure.

Emergency and First Aid Procedures: For dust in eyes, wash immediately with water. If irritation persists, seek medical attention. For gross inhalation, remove person immediately to fresh air and give artificial respiration as needed, seek medical attention as needed.

SECTION VII – PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be taken in Case Material is Released or Spilled:

Spills: Use dustless methods (vacuum) and place into closable container for disposal, or flush with water. Do not dry sweep. Care should be taken to avoid high aerosol dust concentrations. Wear protective equipment specified below. Spilled material may become very slippery when wet with water, grease, oil, gasoline, or solvents.

Waste Disposal Method: Dispose in accordance with Federal, State and Local regulations.

Precautions to Be Taken in Handling and Storing: Avoid breakage of bagged material or spills of bulk material. See control measures in Section VIII.

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 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 YOUR CUSTOMERS-USERS IN CASE OF RESALE) BY POSTING AND OTHER MEANS OF THE HAZARDS 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 for Health Requirements Relating to Occupational Exposure to Quartz Dust.

SECTION VIII – CONTROL MEASURES

Respiratory protection (Specify type)

The following chart specifies the types of respirators which may provide protection for respirable crystalline silica that may be contained in Sepiolite Clay dust.