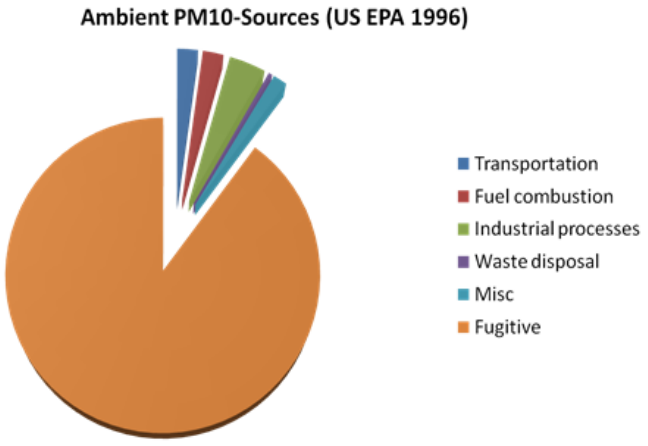
Crystalline Silica

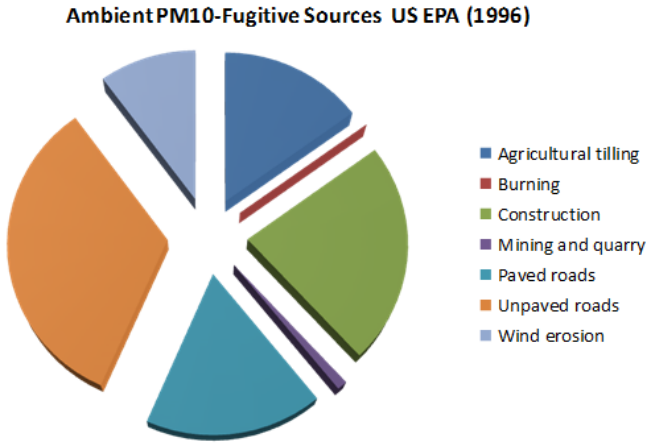
What is crystalline silica?

Crystalline silica in the form of quartz (which we will refer to as "crystalline silica" or "silica") is the second most common material in the earth's crust, making up 12% of the earth's crust. Because silica is so common, it is found everywhere -- in dirt, sand, gravel and rocks. It is a common part of most building products. It is in the concrete, brick, mortar, ceramic tile, ceramic sanitary ware (toilets), shingles and other items that are used in the construction of all homes. It is in the asphalt or concrete used to pave roads, the concrete to make sidewalks, airport taxiways and runways, the crushed stone upon which railroad ties and track are placed, and the other stone, gravel, concrete, and asphalt components of our transportation infrastructure. It is the primary raw material for all glass. It is the primary material from which molds and cores are made to make metal shapes in foundries, which in turn are used extensively in cars, trucks, rail cars and many other things. And, it is used as a proppant to facilitate the recovery of oil and natural gas.

Is crystalline silica in the air? Where does it come from?

Yes, because crystalline silica is so common, it is in the air at low levels nearly everywhere. In 1996, the U.S. EPA published a review of the data concerning "ambient" crystalline silica levels. Ambient crystalline silica levels are those outside of a work place; that is, the levels of crystalline silica in the air outside of the property of a plant, quarry or any other work site. The U.S. EPA reported that ambient crystalline silica levels in the United States are up to 8 µg/m^3 (micrograms per cubic meter), and estimated an average ambient silica level (measured as PM10) in urban areas of 1.9 µg/m^3, with a range of 0.8 to 5.0 µg/m^3. Based on the available particulate matter data, the U.S. EPA concluded that: (1) about 90% of ambient crystalline silica comes from fugitive dust sources, and (2) the largest fugitive dust sources are unpaved roads, paved roads, construction and agricultural tillage. The U.S. EPA concluded that mining and quarrying contribute only 1% of the ambient dust, roughly 15 times less than agriculture.





Is crystalline silica dangerous to health?

There is no evidence that the low levels of crystalline silica found in the ambient air in the United States or around industrial sand mines cause illness or disease.

While there is no evidence that ambient exposures to crystalline silica at levels present in the U.S. cause illness or disease, it is well established that *occupational* exposure to crystalline silica can cause the *occupational* disease silicosis and other diseases. Silicosis can occur after prolonged exposure to respirable crystalline silica at levels above the permissible exposure limits set by the US Occupational Safety and Health Administration (OSHA), which regulates general industry and construction, and the US Mine Safety Health Administration (MSHA), which regulates mining. The permissible exposure level established by OSHA and MSHA is a formula (10 ÷ %silica+2), which approximately equals 100 µg/m^3. WISA members have committed to limiting the exposure of their employees to levels lower than the levels than permitted by MSHA, and all WISA members are committed to the prevention of silicosis among their employees.

Two papers have presented case reports of "environmental" (ambient) silicosis in other countries, one involving persons who lived in the Negev Desert, and the other involving inhabitants of several villages subject to frequent severe dust storms in the Indian Himalaya. The exposures to ambient crystalline silica in these cases were as high as (or higher than) occupational exposures in the U.S, and appear to have exceeded US occupational exposure limits. The circumstances, including the ambient crystalline silica exposure levels, present in these cases are not like the ambient exposures found in the U.S.

How much crystalline silica is in the air around mines?

As noted above, mines contribute a very small part of the overall crystalline silica in the air, far less than farming or dirt roads. But, many have asked – how much crystalline silica is in the air around mines?

There have been articles published on this issue, primarily from sampling done in California. The good news is that the sampling results have shown low levels of crystalline silica around mines, low levels that are similar to the background low levels seen throughout the U.S. For example, crystalline silica levels measured near a quarry by the South Coast Air Quality Management District in California found a maximum 24 hour average silica level of 1.1 µg/m^3; the Monterrey Bay Unified Air Pollution District sampled for crystalline silica near a sand quarry and reported levels of 0.6 and 1.4 µg/m^3 as a 24 hour average; and, John Richards sampled near 2 aggregate quarries and reported crystalline silica levels less than 1.1 µg/m3 as a 24 hour average, and reported higher upwind sampling results because the upwind sampling site was near a dirt road.

Do governments set exposure levels for ambient (environmental) crystalline silica?

The U.S. EPA has evaluated ambient crystalline silica issues in the past; however, the U.S. EPA does not regulate ambient crystalline silica as such and has never proposed reference exposure levels or concentrations for it. The U.S. EPA has established National Ambient Air Quality Standards for "criteria pollutants", and Particulate Matter (PM) is a "criteria pollutant". Particulate matter is what it sounds like – particles, and it includes crystalline silica dust and other dusts of all kind. The U.S. EPA has established a standard of 150 µg/m^3 as a 24 hour average not to be exceed more than once per year for PM10 (particles of 10 micrometers or less) and 12 µg/m^3 as an annual average for PM2.5 (particles of 2.5 micrometers or less).

The California Office of Environmental Health Hazard Assessment (OEHHA) conducted a study of ambient silica health effects and developed an "inhalation reference exposure level" for ambient exposure to respirable crystalline silica of 3 µg/m^3. The reference exposure level, which is not a regulatory limit, means that

California OEHHA concluded that exposure to crystalline silica at a level of 3 $\mu g/m^3$ for 24 hours a day, 365 days a year for 70 years did not create an unacceptable risk of illness.

It is worth noting a few points about ambient standards, whether set by the U.S. EPA or state agencies. First, these standards are set as averages over a period of time, typically a 24 hour average or an annual average. For example, the U.S. EPA PM 2.5 standard is an annual average, which means that the results on any day do not measure whether the standard is complied with –i.e., the results on any day may be above the standard, and as long as the annual average is below the standard, compliance is achieved. Second, the ambient standards are set to protect health assuming a 70 year constant exposure. The result of setting standards on the basis of a 70 year constant exposure makes the standards very conservative, because as a practical matter it is highly unlikely – and in fact probably impossible – that anyone would ever receive a 70 year exposure to anything. To be at risk for the adverse health effect that a lifetime exposure standard is designed to protect against, someone would have to be continuously exposed to the pollutant for 24 hours a day, 365 days a year, for 70 years.

A hypothetical example illustrates the point: (1) a dust has a reference concentration of 1 as an annual average; (2) a quarry measures the dust at its property line and finds an annual average of 1.5, which is more than 1 reference concentration; (3) the closest house is 200 yards away for the quarry property line, and the calculated dust level at the house (outside) is 0.75, which is less than 1; (4) inside the house, the dust level is undetectable; (5) the people who live in the house are away at work 9 hours a day, and so are not exposed to any dust outside the house during this time. In this hypothetical example, the people who live in the house should have no risk of adverse health effects from the dust.

Does Wisconsin regulate ambient crystalline silica?

Yes, Wisconsin regulates ambient crystalline silica in the same manner the U.S. EPA regulates it, as a form of particulate matter. In the August 2011 *WDNR Silica Study*, WDNR concluded that when particulate matter sources are controlled, crystalline silica sources are controlled. WDNR summarized its conclusions as follows: "Wisconsin has regulated PM for 40 years. The controls for PM are the same controls for crystalline silica. This means that for those crystalline silica sources where PM is controlled, crystalline silica emissions are also reduced." (*WDNR Silica Study*, p. 2)

The WDNR revisited its position in January 2012. After a technical and legal review, the WDNR again concluded that "Because silica emissions are a component of particulate matter emissions, existing regulations that govern fine particulate matter can be used to control these emissions." *(WDNR Silica Petition Response, p. 1)*

Do sand mines and processing operations need air permits?

Yes. Wisconsin statutes require that any facility that will emit air pollutants be regulated under an air permit. See Wis. Stat. Ch. 285. WISA member companies all operate under WDNR-issued air permits, which limit particulate matter emissions and therefore crystalline silica emissions to the ambient air. Sand mining and processing facilities have top soil, dirt, clays, gravel, crushed stone and other products of the earth that are driven on, piled up and otherwise disturbed, and all are potential sources of dust. As part of the air permits for these facilities, WDNR requires fugitive dust control plans. WISA member companies have and follow fugitive dust control plans to minimize the dust from these sources.

Through recurrent process improvement and strategic design, WISA member companies continue to minimize air emissions to levels that are less than permit-allowed limits.

Is the sand being mined in Wisconsin different from other sand?

The sand being mined by WISA member companies is the same sand that is present on many beaches, used by local highway departments on winter streets, sold as play sand, exposed in agricultural land, and present on the thousands of miles of unpaved roads in Wisconsin. It just tends to be a somewhat rounder and purer than common sand made of silica, which is why it's useful as a proppant in the extraction of oil and natural gas.

Do mining and processing facilities in Wisconsin "fracture" the sand?

No. Industrial sand mining in Wisconsin does not fracture the sand. The sand WISA members mine is comprised of the same small sand grains that you see on many beaches, but the grains are stuck together into sandstone. The mining and processing simply separates grains that are stuck together into individual grains, which are then sorted by size. The sand mined in Wisconsin consists of spherical and rounded sand grains, not broken angular sand grains. Mining and processing does not break the sand grains into smaller sand grains, which would essentially "fracture" the finished product.

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