Free silica is uncombined silicon dioxide (SiO_2) Silicates contain silicon and oxygen combined with other elements in more complex molecules The SiO_2 reported in chemical analyses for mineral and geological reports is the *total* of the silicon dioxide present, both the free silica (if present), and the silica combined in the mineral Such analyses are not reliable indications of the silicosis potential of the material, because it is the uncombined or free silica that is most important in industrial dust exposure. So that an exposure can be properly evaluated, the percentage of uncombined silica must be determined by petrographic analysis using a polarizing microscope or, preferably, by X-ray diffraction analyses and special analytical chemical procedures

There has been some experimental evidence that some dusts may tend to inhibit the action of silica on the body, but this inhibiting action is so slight and uncertain that it must be discounted in practice In fact, there is also evidence that the nonsiliceous components of a dust mixture containing free silica may provoke a disabling condition more severe than that caused by the silica acting alone

With the exception of asbestos and some talcs, the silicate dusts do not ordinarily cause a serious disabling lung condition such as is produced by free silica Much higher levels of silicate dusts than of free silica dust can be tolerated In many industries, men have worked with silicate dusts that contained no free silica without development of disability or of nodulation in the lungs The X-ray may show shadows indicating dust deposits in the lungs, but the pneumoconiosis is essentially harmless However, partially disabling pneumoconioses have been reported where men have worked for long periods of time in very high concentrations of certain silicate dusts Disabling pneumoconioses from exposure to abnormally high concentrations of mica, tremolite talc, and kaolin dusts have been described in the literature The clinical signs are not the same for these silicate dusts as for free silica, but the symptoms can be marked

Asbestosis Several minerals having a fibrous character are classed as "asbestos"—hydrated silicates of magnesium with variable amounts of iron, calcium, sodium, potassium, and aluminum present as impurities The fine airborne fibers of asbestos can pass through the upper respiratory tract to the lower parts of the lungs to cause irritation and to form "asbestos bodies" where the fibers are encapsulated. This diffuse fibrosis probably begins as a "collar" about the terminal bronchioles. There is evidence that other minerals having a fibrous character (except glass fiber) can produce a reaction similar to that of asbestos.

Following a study by the U.S Public Health Service of the asbestos textile industry,* it was recommended that the dust concentration be kept at less than 5 mppcf to prevent asbestosis Evaluation of an exposure to asbestos dust is based on the *total* amount of dust, since the concentration of injurious fibers will be kept within safe limits if the fine dust is kept below the suggested threshold limit

Miscellaneous pneumoconioses Even though a dust is classified as harmless, amounts above the TLV can lead to trouble by causing a pneumoconiosis, mechanically irritating the walls of the respiratory system, or interfering with ordinary lung processes Mica dust and kaolin dust are two good examples of dusts that ordinarily are considered benign but amounts above the TLV can cause a troublesome pneumoconiosis. Mica pneumoconiosis has been observed in grinding operations where mica dust, but no free silica was present There were marked changes in the X-ray pictures of the lungs and some disability The cases occurred where the dust exposures were massive over many years

Toxic dusts and fumes

Systemic reactions are caused by toxic dusts and fumes of various elements and their compounds and by certain organic compounds. All metallic fumes are irritating, especially when freshly generated Industrially important metals and their compounds that can have a toxic effect when the dust or fumes are inhaled include arsenic, antimony, cadmium, chromium, lead, manganese, mercury, selenium, tellurium, thallium, uranium, and a few others.

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*U.S. Public health Service, Washington, D C. "A Study of Asbestosis in the Asbestos Textile Industry." Bulletin No 241 1938