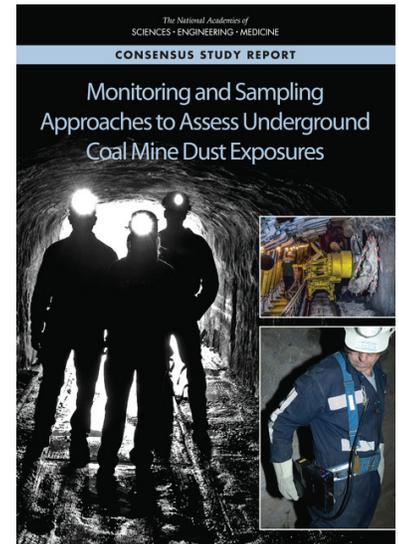




## Monitoring and Sampling Approaches to Assess Underground Coal Mine Dust Exposures

In response to a congressional request, a committee of the National Academies of Sciences, Engineering, and Medicine evaluated monitoring methods that coal mine operators use to help control underground miners' exposures to respirable coal mine dust. The committee's report finds that black lung and other coal mine dust lung diseases continue to be an important and complex problem affecting coal miners in the United States. Progress toward the elimination of those diseases will need to involve voluntary monitoring strategies by coal mine operators to augment the outcomes expected from compliance with the current regulatory requirements. The committee's report also recommends research and development activities to support the long-term success of those strategies. The National Institute for Occupational Safety and Health (NIOSH), Mine Safety and Health Administration (MSHA), and other organizations will need sufficient resources and capacity to support the recommended activities.



### PERSISTENT RISKS OF BLACK LUNG DISEASE

Coal mine dust consists of coal and other particles that vary according to mine geology and mining practices. It is likely that more than one type of particle in the dust contributes to disease risk in miners. Beginning in 1969, regulatory requirements placed limits on the concentration of coal mine dust in the air of underground mines and the dust's concentration of crystalline silica, which is a known contributor to lung disease. Those requirements, along with improved medical surveillance programs, led to a substantial decline in cases of black lung disease from 1970 to 2000, across all coal mining regions in the United States. However, since around 2000, NIOSH reported an unexpected upward trend in black lung cases in coal miners who have worked 15 or more years. More recently, a cluster of cases of severe and fatal forms of disease have been documented in central Appalachia.

The reasons for the increase in lung disease are not clear but could be related to changes in mining practices. For example, the use of heavier, more powerful equipment has made it easier to cut through more rock to mine thinner coal seams. If that rock is high in crystalline silica, miners could be exposed to dust with elevated concentrations of silica which can increase health risks.

A rule issued by MSHA in 2014 lowered the allowable dust concentrations in underground mines. That regulation, which went into effect in 2016, continues the past regulatory focus on controlling the total concentration of coal mine dust and the fraction of crystalline silica in it. The rule also requires miners in occupations with high dust exposure to use continuous personal dust monitors on a periodic basis. The portable monitor provides exposure information in near real time, so that mine operators can take corrective actions immediately when dust readings are high. However, only a small segment of miners is required to use a personal monitor during any given shift.

Although total dust concentrations are monitored in real time, the crystalline silica content of the dust is not. Collected samples must be mailed away to a laboratory for analysis, leaving no opportunity to take immediate corrective actions in response to elevated silica concentrations.

Data from industry monitoring indicate more than 99 percent compliance with the MSHA requirements related to dust concentrations. However, given current uncertainties about the cause of an upward trend in black lung disease, the committee noted the possibility that high rates of operator compliance may not guarantee that future cases of disease will decline. It is difficult to assess the effect of the current requirements on miners' health at this time because the latency period of black lung disease onset is typically 10 or more years and sufficient time has not elapsed since the requirements were implemented.

## GOING BEYOND REGULATORY COMPLIANCE

There is a need for a more in-depth understanding and control of risk factors, some of which may not be captured by the monitoring approaches required by current regulations. Aside from crystalline silica content, there is no requirement related to monitoring the composition of the coal mine dust, how the composition varies, and the sources of the constituents. To make continued progress toward the goal of eliminating black lung disease, mine operators need to go beyond current regulations and embrace additional voluntary monitoring and sampling to augment the outcomes expected from regulatory compliance.

For example, mine operators could apply monitoring devices in certain areas in a mine that have the potential for high dust concentrations, depending on technical conditions of machinery, geologic conditions, and the type of dust control measures being used. The monitor readings would not be used for determining regulatory compliance; instead, they would be used for identifying high dust concentrations at specific sites that might warrant additional dust control actions by the operator.

## RESEARCH AND DEVELOPMENT TO ENSURE LONG-TERM SUCCESS

To support the long-term success of exposure control efforts, research and development activities are needed for a better understanding of relationships between miners' exposures and disease, including studying effects of changes in mining practices. In addition, improvements in monitoring technology should include reduction in cost and weight of continuous personal dust monitors and development of a real-time crystalline silica monitor. As an interim measure, development of a commercially available end-of-shift crystalline silica monitor should continue. Studies are needed to identify ways of increasing miners' voluntary participation in medical surveillance programs, and enhancing worker training and education.

NIOSH, MSHA and other organizations clearly will need sufficient capacity and resources to support the recommended research and development activities.

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**For More Information . . .** This Consensus Study Report Highlights was prepared by the National Academies of Sciences, Engineering, and Medicine based on the Consensus Study Report *Monitoring and Sampling Approaches to Assess Underground Coal Mine Dust Exposures* (2018). The study was sponsored by the National Institute of Occupational Safety and Health. Any opinions, findings, conclusions, or recommendations expressed in this publication do not necessarily reflect the views of any organization or agency that provided support for the project. Copies of the Consensus Study Report are available from the National Academies Press, (800) 624-6242; <http://www.nap.edu> or via the Board on Earth Sciences and Resources web page at <http://www.nationalacademies.org/besr>.

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