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Technology News

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Minimizing Respirable Dust Exposure in Enclosed Cabs by Maintaining Cab Integrity

Objective

To minimize the equipment operator's respirable dust exposure in enclosed cabs of mobile equipment by installing cab filtration and pressurization systems and by keeping doors and windows closed.

Background

Enclosed cabs are used on mobile equipment to protect operators from health and safety hazards. The primary health concern is overexposure to respirable dust. Examples of such equipment in mining include drills, dozers, haul trucks, and other equipment. When equipment is new, the operator's dust exposure is normally at acceptable levels. As the equipment ages and gaskets and seals deteriorate, the air quality inside an enclosed cab can reach a point where it is no longer at acceptable levels for the equipment operators.

In an effort to improve the air quality in enclosed cabs of older mining equipment, NIOSH has been performing research to retrofit cabs with new filtration and pressurization systems. Over the past few years, this research has shown that retrofit systems can substantially improve the cab's air quality back to safe and acceptable levels. However, this is only possible when a positive cab pressure is achieved and maintained. Thus, when a cab door or window is opened, the cab pressure drops to zero and the cab filtration and pressurization system is rendered ineffective. During a recent field study, the magnitude of this impact was noted when a drill operator repeatedly opened the cab door throughout the course of the drill cycle. Upon closer examination, it was determined that the cab door was being opened to manually guide the next drill steel into place each time an additional section of steel was needed to drill deeper holes.

Approach

A recent test was performed to evaluate a new unidirectional flow cab filtration and pressurization system installed on an enclosed cab of a surface drill at a stone operation. During this test, instantaneous respirable dust monitors were placed inside the enclosed cab to evaluate the effectiveness of this new system. These monitors recorded the average respirable dust concentration every 30 sec on the instrument's internal datalogger. While performing this testing, it was noted that the drill operator repeatedly opened the cab door to manually guide a new drill steel into place each time an additional section was needed. During this evaluation, the operator was drilling holes to a depth that required the use of five steels. When the drill steel was advanced the entire length, the operator went through a series of tasks to remove the drill steel from the powered drive head, obtain another drill steel and swing it into place. At this point in the process, the drill operator opened the cab door, leaned out, and with

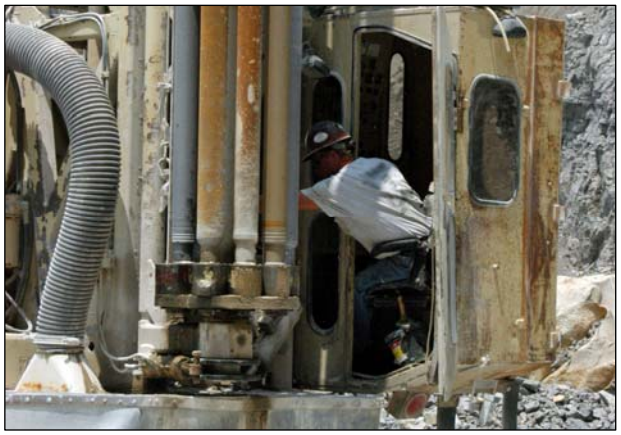

Figure 1.—Drill operator reaching out of cab door to guide new drill steel into place.

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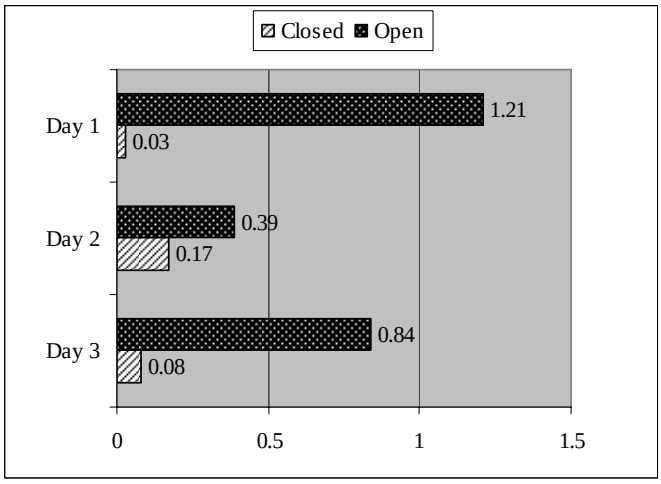

Figure 2.—Average respirable dust concentration (mg/m^3) inside drill cab during periods with the cab door closed and open for 3 days of testing.

his left arm manually guided the drill steel into the previous steel (Figure 1). When the new steel was completely threaded down tight into the previous steel, the drill operator closed the cab door and began drilling again. The total time to add a new drill steel was roughly 3 min. At approximately 2 min into the process, the drill operator would open the cab door to guide the next drill steel into place. The cab door was normally open somewhere between 30 and 45 sec each time this process took place before being closed again. Since no drilling was occurring and no dust cloud was visible as the cab door was opened, the impact to the drill operator's respirable dust exposure was initially thought to be insignificant.

Results

When the instantaneous respirable dust data from inside the enclosed cab were analyzed, a substantial increase in respirable dust concentrations was noted during the periods when the door was open. This increase was especially significant when one considers that drilling had ceased approximately 2 min before the door was opened. Figure 2 shows average concentrations for 3 days of testing for time periods when the cab door was closed and opened. The average concentration was 0.09 mg/m^3 with the cab door closed and 0.81 mg/m^3 with the door open. Despite no visible dust cloud during the time when the cab door was open, respirable dust concentrations inside the cab were nine times higher than when the door was closed. Additionally, once dust enters and coats the inside of the enclosed cab, it exposes the drill operator every time it is disturbed and becomes airborne, even with the cab door closed.

The results of this testing indicate the significant impact of an open door or window on dust concentrations inside an enclosed cab. In operations where the cab door or window may be opened for longer time periods, especially in operations with higher outside dust concentrations or higher silica contents, the practice could have an even greater impact on the operator's dust exposure.

Recommendations

Cab filtration and pressurization systems should be installed on enclosed cabs of all mining equipment to improve the air quality to the operator. In addition, every attempt should be made to keep cab doors and windows closed at all times in an effort to keep the cab pressurized and working properly. The only exception to opening a door should be when the equipment operator enters or exits the enclosed cab. For mining operations using drills that require the operator to manually guide drill steels into place, the drill manufacturer should be contacted to purchase systems that have been developed to provide for drill steel stabilization, eliminating the need for this task to be performed by the drill operator.

For More Information

For more information about reducing dust exposure in enclosed cabs, contact Andrew B. Cecala (412-386-6677, ACecala@cdc.gov) or John A. Organiscak (412-386-6675, JOrganiscak@cdc.gov), NIOSH Pittsburgh Research Laboratory, P.O. Box 18070, Pittsburgh, PA 15236-0070.

Publications on dust control in the mining industry, including cab filtration and pressurization systems, can be downloaded from the NIOSH Mining Web site at http://www.cdc.gov/niosh/mining/pubs/programareapubs9.htm.

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