



Technology News

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Total Mill Ventilation System for Mineral Processing Facilities

Objective

Reduce the dust exposure of workers in large processing buildings at mineral processing operations, using a total mill ventilation system.

Background

Many mineral processing operations have difficulty meeting Federal standards for respirable dust. All mineral processing operations use some type of engineering controls to address their most significant dust sources. Engineering controls include such things as baghouse-type dust collectors, scrubbers, and electrostatic precipitators.

Although the most serious dust sources are being addressed at these operations, there are usually a number of minor, less significant dust sources that are not addressed. Some of these minor dust sources do not lend themselves to being controlled by standard engineering techniques. These minor dust sources include such things as product residue on walls, beams, and equipment, which becomes airborne from the vibration of the processes and equipment operating within the mill; product on walkways and access areas, which becomes airborne as workers walk throughout the mill; dust released or generated from improper housekeeping practices; and product released from screens or other milling processes when covers or lids are opened.

In mineral processing operations that have many minor dust sources, dust levels gradually increase as the day or shift progresses. In some cases, the combined effect of these minor sources can cause mill workers to exceed

Federal compliance standards for respirable dust. One cost-effective supplemental dust control method to reduce the effect of these minor dust sources is the use of total mill ventilation systems.

A total mill ventilation system can lower mill-wide dust concentrations, hence reducing respirable dust exposures of workers in mineral processing operations. The system uses clean air drawn in at the base of the building to dilute and remove dust from contaminated areas within the mill structure. This dust-laden air is then exhausted out near the top of the building.

How It Works

A total mill ventilation system draws dust-free makeup air in near the base of the mill and then uses this air to provide a gradual purging of the building, thus clearing some of the dust-laden areas throughout the mill structure. Wall louvers are installed to control where the makeup air is brought into the structure. The makeup air must be uncontaminated or it could increase dust levels within the structure.

The air is discharged at or near the top of the structure, away from plant personnel working outside. This total mill ventilation system uses axial fans positioned at various locations either across the roof or very high on the walls of the structure. The quantity of air exhausted is normally in the range of 10 to 30 air changes per hour based on the volumetric capacity of the building. Dust levels in the structure, height and competence of the outside walls of the structure, and weather conditions are a number of the factors that account for the variation in the ventilation

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range. In addition, thermodynamic effects from heat generated by mill equipment produce a chimney effect, thus assisting the basic flow pattern from the bottom to the top of the structure.

Without this exhaust system, dust can exit the building through open doors, windows, etc., and contaminate outside plant workers. It can also be recirculated back into the mill building, causing additional contamination problems. A total mill ventilation system is not a stand-alone technique, but a supplemental technique to assist other localized dust control systems.

Approach and Results

Total mill ventilation systems were installed and evaluated at two mineral processing operations. Both systems proved to be very cost effective at reducing respirable dust levels throughout the structure and reducing worker exposure.

A 25,000-cubic-foot-per-minute (cfm) system installed at a clay processing mill provided approximately 10 air changes per hour at this 150,000-cubic-foot (ft^3) structure. This system reduced respirable dust concentrations by approximately 40 percent throughout the mill building. The graph shows respirable dust concentrations recorded by a RAM-1 instantaneous respirable dust monitor for times when the ventilation system was on and off. The cost of all material and installation for this system was approximately \$10,000.00.

The second evaluation was performed at a silica sand operation. Tests were performed with 50,000 and 100,000

cfm of ventilation to the 177,000- ft^3 mill building, corresponding to 17 and 34 air changes per hour. Average mill-wide respirable dust concentrations were reduced 36 and 64 percent, respectively, at a cost of only \$6,000.00.

Not only did these systems reduce respirable dust concentrations and increase visibility throughout the mills, they were also easy to install and require minimal maintenance. A total mill ventilation system provides a general purging of the mill air; the system should be viewed as a supplemental technique to assist other dust control systems in operation. The total mill ventilation system ranks high when compared with other process-specific dust control techniques on a cost-benefit basis. Considering the cost awareness of the industry and the new pending respirable dust standards for metal/nonmetal operations, the total mill ventilation system is a technique that deserves consideration.

For More Information

More information is given in USBM Report of Investigations 9469, "Reducing Respirable Dust Concentrations at Mineral Processing Facilities Using Total Mill Ventilation Systems." For additional information, please contact the principal investigator for this research: Andrew B. Cecala, U.S. Bureau of Mines, Pittsburgh Research Center, P.O. Box 18070, Cochrans Mill Road, Pittsburgh, PA 15236-0070, Telephone: (412) 892-6677.

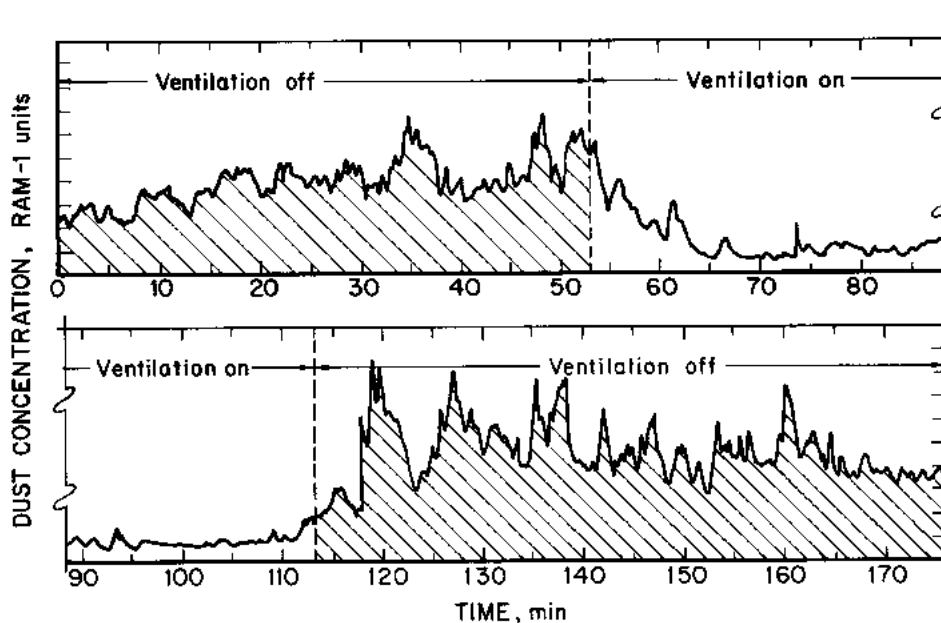


Figure 1.—Respirable dust concentrations during evaluation of total mill ventilation system.