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Personal Noise Measurements

Noise is unwanted sound. There are many noise sources in coal and metal/nonmetal mines, such as drills, crushers, diesel engines, grinding mills, trucks, and other vehicles and machinery. When noise exposure is too intense, too shrill, or too prolonged, such exposure may cause harm to miners. The adverse effects of noise exposure include temporary or permanent hearing loss, interference with speech and audible warning signals, and physical and psychological effects such as fatigue, irritability, tension, anxiety, and circulatory effects. Sudden blasts of noise can rupture the ear drum or damage the bones of the middle ear. Noise-induced hearing loss is the gradual loss of hearing that may occur on long or repeated exposure to intense noise. Such damage occurs at the organ of Corti in the inner ear and may become permanent. There is no known medical treatment to correct such hearing loss - emphasizing the importance of prevention. One of the first symptoms of noise-induced hearing loss is loss of hearing at the higher frequencies including 4000 Hz. Such loss may go unnoticed, but with increasing exposure, the loss increases and may involve the speech frequencies (500 to 3000 Hz). The MSHA noise standard has three levels of noise exposure where corrective action must be instituted. These limits are the Action Level (AL), Permissible Exposure Level (PEL), and the Dual Hearing Protection Level (DHPL). The corrective actions differ for each limit. The lowest level is the AL. Whenever a miner's noise exposure equals or exceeds 85 dBA for 8 hours or equivalently a dose of 50% based on an 80 dBA threshold measurement, the miner must be enrolled in a Hearing Conservation Program (HCP). A miner in the HCP must undergo training on the noise rule and the effects of noise on a person and the care fitting and use of hearing protectors. In addition the miner must be offered a choice of hearing protector and audiometric testing.

The PEL is 90 dBA for 8 hours or equivalently a dose of 100% based on a 90 dBA threshold measurement. Readings greater than 100% indicate exposure above the allowable limit. An exposure of 200%, for example is twice the allowable limit and corresponds to a continuous noise exposure of 95 dBA for 8 hours. Mine operators would be required to implement feasible engineering and/or administrative controls to reduce the noise exposure to the PEL. If the noise exposure cannot be reduced to the PEL, the mine operator would be required to continue to use all feasible engineering and administrative controls to reduce the miner's exposure to the lowest level feasible, and to have the miner wear hearing protection. Also, the miner would be enrolled in a HCP.

The DHPL is 105 dBA for 8 hours or equivalently a dose of 800% based on a 90 dBA threshold measurement. This level requires more protective measures be instituted to protect the hearing sensitivity of miners. Besides the requirements for exceeding the PEL, mine operators would be required to have their miners exposed above this level wear ear muff and ear plugs simultaneously.

Most noises at mining operations vary in level and frequency during a working shift. The allowable level varies with the time of exposure; as the time of exposure decreases, higher levels are permitted. For example, the maximum allowable level for 4 hours exposure per day is 95 dBA, and for 2 hours, 100 dBA, with a final maximum allowable level of 115 dBA for exposure of 15 minutes or less per day. In other words, for every 5 dBA increase in the sound

level the permissible exposure time is halved. MSHA measures personal noise exposure by means of a personal noise dosimeter. This instrument, which includes a microphone worn on the shoulder by the miner, collects data for a full shift. This instrument responds to and measures all noise above the threshold to which it is exposed, and expresses the result as a percent of the allowable exposure at 90 dBA. A citation for excessive noise exposure is not issued until the exposure as measured with a personal noise dosimeter reaches 2 dBA above the exposure limit. The reason for this is that the personal noise dosimeter has associated with it a range of uncertainty, or tolerances of + 2dBA. This corresponds to 66% at the AL, 132% at the PEL, and 1056% at the DHPL.

In addition to using a personal noise dosimeter, an MSHA inspector may make additional measurements with a sound level meter. The sound level meter allows the inspector to determine sound levels at specific locations at a given time. Such measurements are useful in locating excessively noisy areas, in determining which machines are the primary noise sources, and also in checking on the reliability of personal noise dosimeter measurements.

When an MSHA inspector places a personal noise dosimeter on a miner, it is important that the miner perform his/her work in the ordinary way, and that he/she not tamper with the device or create abnormal noises, either accidentally or intentionally. If there is an abnormal work stoppage or something that interferes with the personal noise dosimeter or its placement on the miner, the inspector should be notified.

Regulations require that, when noise exposure exceeds the allowable limit as measured with a dosimeter, mine operators use feasible administrative or engineering controls to reduce noise exposures and maintain them within the PEL. Engineering controls include exhaust mufflers, enclosures, barriers, acoustically treated cabs for mobile equipment, and any structures or devices which actually reduce the levels of noise reaching the miners' ears. Administrative controls refer to scheduling of operations and work periods so as to reduce the time of exposure for the miners involved. Personal hearing protection is not acceptable for control of noise exposure. If feasible engineering or administrative controls do not exist, or such controls fail to reduce noise exposure to permissible limits, personal hearing protection devices must be used as an interim solution. Personal hearing protection devices -- ear plugs or earmuffs -- do not always provide the protection expected because of field use limitations. To be effective, personal hearing protectors must be properly selected, fitted, cleaned, maintained, and worn. If you have any questions about this or any other occupational health matter, feel free to ask us. Our job is protecting your health.

Contact:

Mine Safety and Health Administration
Metal and Nonmetal Health Division
1100 Wilson Boulevard
Arlington, Virginia 22209-2929
Phone: (202) 693-9600

Mine Safety and Health Administration
Technical Support
1100 Wilson Boulevard
Arlington, Virginia 22209-2929
Phone: (202) 693-9470

Mine Safety and Health Administration Coal
Health Division
1100 Wilson Boulevard
Arlington, Virginia 22209-2929
Phone: (202) 693-9500