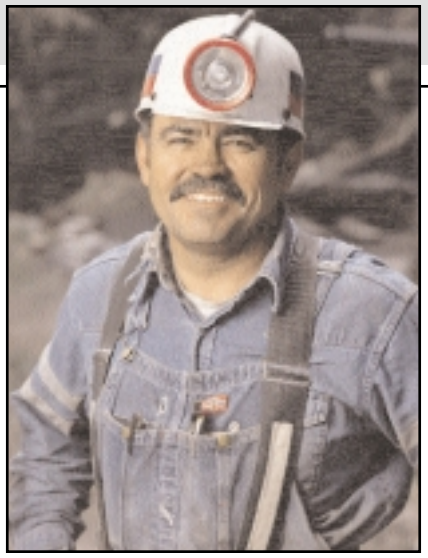
QUEST TECHNOLOGIES

USER APPLICATION NEWS NOTE 2

Occupational Noise Exposure in U.S. Mines

INTRODUCTION

The U.S. Mine Safety & Health Administration (MSHA) published a new occupational noise exposure rule on September 13, 1999. **The new rule applies to all coal, metal and non-metal mines and became effective September 13, 2000.**



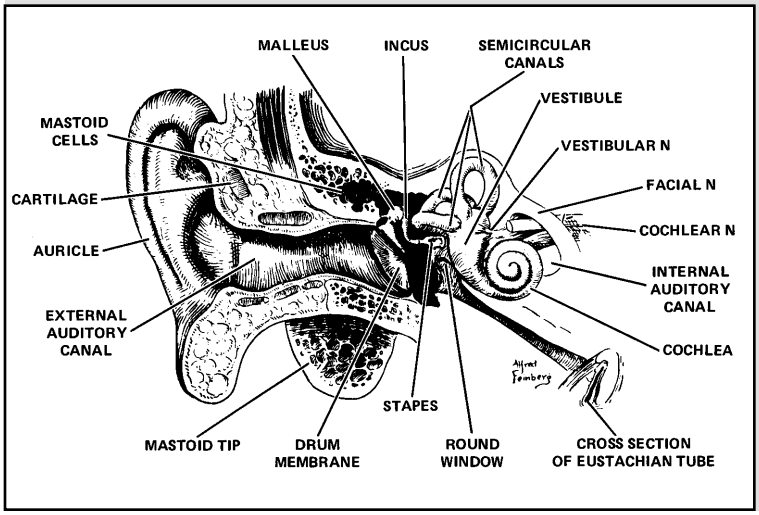
HEALTH & OTHER RISKS

Noise is one of the most pervasive health hazards in mining. The National Institute for Occupational Safety and Health (NIOSH) has identified occupational noise-induced hearing loss as one of the ten leading work-related diseases and injuries. MSHA estimated that 13% of the mining population of the United States (about 37,000) would develop material hearing impairment during their working lifetime under the previous noise standards.

Prolonged exposure to hazardous sound levels over a period of years can cause permanent, irreversible damage to hearing. Hearing loss may occur under prolonged exposure to high sound levels, or gradually when levels are lower and exposures less frequent. An individual may not notice hearing impairment until after substantial hearing loss occurs. **In addition to adversely affecting the quality of life, hearing impairment can jeopardize the safety and productivity of affected miners as well as those around them.**

ROOT CAUSES

When the ear receives an acoustic signal, it first travels through the canal where the pressure changes move the tympanic membrane (ear drum). Located behind the eardrum is the middle ear in which the three smallest and hardest bones in the body are found: malleus, incus and stapes (hammer, anvil and stirrup). These bones are connected in a chain between the tympanic membrane and the round window of the cochlea (inner ear). When exposed to noise these bones start to vibrate and act as an amplifier converting sound energy into mechanical energy. The mechanical energy is then converted into hydraulic energy in the cochlea. The fluid that has been set in motion in the cochlea will, depending on the signal frequency, affect different small hair-like cells in the cochlea. When a hair cell is stimulated it sends an electrical signal to the brain and the hydraulic energy is converted to electrical energy. A noise induced hearing loss in the inner ear occurs when the small hair-like cells become damaged or weaken due to overload (noise exposure).



The objective of the new MSHA Occupational Noise Exposure Standard is to reduce or eliminate the damage to these hair-like cells, which is the "root cause" of noise induced hearing loss. To aid in these efforts, MSHA has defined for the mine operator specific exposure limits. Mine operators are required to establish a system of monitoring that evaluates each miner's noise exposure sufficiently to determine continuing compliance with the rule.

MAJOR NOISE EXPOSURE LIMITS

Action Level	An 8-hour time-weighted average (TWA_8) sound level of 85 dBA integrating all sound levels from 80 dBA to at least 130 dBA
Permissible Exposure Level (PEL)	An 8-hour time-weight average (TWA_8) sound level of 90 dBA integrating all sound levels from at least 90 dBA to 140 dBA
Maximum Exposure Level	115 dBA at any time even if wearing hearing protection
Dual Hearing Protection Level	Any time the TWA_8 exceeds 105 dBA

SOLUTION

The rule specifies how a miner's noise dose is to be determined, but otherwise it is performance-oriented and neither the methodology nor the intervals of monitoring are specified. Fortunately simplified and cost effective methods are now available for the mine operator to assess a miner's noise exposure.

Q-300 Noise Dosimeter

There are two basic types of instruments commonly used to sample noise. The first is a noise dosimeter, which measures personal exposure to noise. It consists of a microphone (placed in the miner's hearing zone) and a case containing the microprocessor-controlled monitor. The dosimeter continuously monitors, integrates and records the sound energy a miner is exposed to during the shift. This information is used by the dosimeter to generate all of the calculated values required by the rule for determining a miner's noise exposure. Examples of calculated values include:

Dose - Indicates the percentage of the PEL the miner has received during the actual period of testing.

Maximum Exposure Level - Indicates the highest sound level recorded at any time during the test.

TWA_8 - Indicates the 8-hour time weighted average noise exposure for the miner.

In their most basic and economical configuration dosimeters provide results to the mine operator via an integral display. Other features possibly present in the dosimeter include the ability to generate hard copy reports directly to a printer and/or the ability to interface to a computer for storage, retrieval, analysis and reporting of exposure data on a desktop or notebook PC.

The second type of instrument is a sound level meter (SLM). The major difference between the SLM and the dosimeter is that the SLM is not intended to be worn by the miner. The primary applications for SLM's are in handheld surveys or area measurements. A broad range of SLM's are available with varying levels of functionality. Very basic SLM's might only provide an indication of the current decibel or sound level (SPL) and the maximum sound level detected. The most advanced SLM's enable the mine operator to understand the frequency components of the noise so that appropriate engineering controls may be selected and applied. This type of SLM is referred to as an Octave Band Analyzer.

Quest Basic Series Sound Level Meters

Quest Technologies offers several unique SLM and dosimeter solutions that allow the mine operator to determine a miner's noise exposure and assist in the implementation of administrative and engineering controls. Both sound level meters and dosimeters have significant value in an effective noise exposure management program.

SLM's allow the mine operator to:

- Perform initial walk through surveys of their operations to determine which subset of miner's are candidates for dosimeter studies.
- Develop a noise level map of their operations to facilitate implementation of effective administrative controls.
- Understand the frequency content of the noise in their operations to facilitate selection and implementation of the proper engineering controls.
- Test new incoming equipment for compliance with specified noise emission limits.
- Periodically test existing equipment for undesirable changes in noise emission levels as a result of mechanical wear.
- Perform follow-up walk through surveys of their operations to determine continuing compliance with noise exposure limits.

Dosimeters allow the mine operator to:

- Monitor the miner's exposure throughout the work shift without being physically present.
- Understand the miner's total noise dose under circumstances where the noise levels vary throughout the day.
- Determine the miner's full shift noise dose without conducting full shift sampling under circumstances where the noise levels are continuous throughout the day.
- Understand if the miner's noise exposure ever exceeded the 115 dBA maximum exposure level.
- Understand if the miner's noise exposure ever exceeded the 105 dBA dual hearing protection level.

ABOUT QUEST TECHNOLOGIES

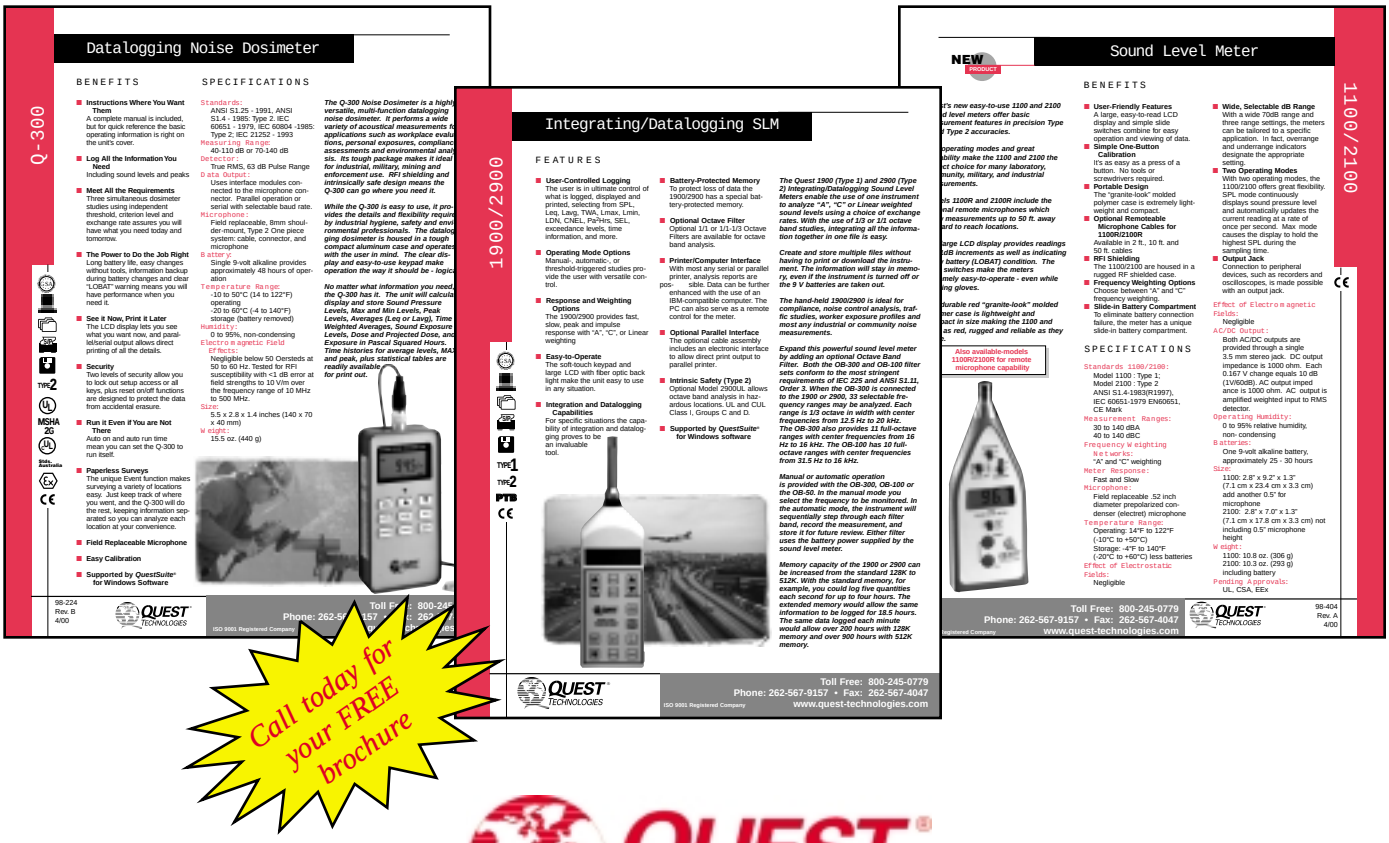
Quest Technologies is one of the most widely recognized and respected manufacturers worldwide for life safety & health instrumentation and software. It is through our lifelong commitment to continuous quality improvement, product innovation and a mission to delight our customers that we have achieved this status. We specialize in regulatory compliance and personal safety solutions for noise, heat stress, indoor air quality and toxic/combustible gas monitoring applications. Quest Technologies solutions are available worldwide through a network of factory authorized dealers that specialize in life safety & health solutions.

FOR MORE INFORMATION

If you have any questions concerning our technology, pricing, availability or would like to schedule a product demonstration, you may contact our customer service representatives at (800) 245-0779 or e-mail us at sales@quest-technologies.com.

PERTINENT WEBSITE LINKS

U.S. Mine Safety & Health Administration (MSHA)	http://www.msha.gov
National Institute for Occupational Safety & Health (NIOSH)	http://www.cdc.gov/niosh
National Hearing Conservation Association	http://www.hearingconservation.org
American Industrial Hygiene Association	http://www.aiha.org



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