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Identifying the Benefits of Engineering Noise Controls Through a Business Case

Objective

To develop a business case that promotes adoption of noise controls by reducing barriers to industry acceptance and enhancing drivers that foster their implementation.

Background

Over 75% of the U.S. mining workforce is exposed to hazardous noise, putting them at risk of noise-induced hearing loss (NIHL). Consequently, coal miners suffer high rates of hearing impairment that increase to 70%–90% by retirement age. To address the noise problem for coal miners, researchers from the National Institute for Occupational Safety and Health (NIOSH) first determined that the continuous mining machine (CMM) ranked first among machines associated with reported coal noise overexposures. Further studies found that most CMM noise is generated by three component systems on the machine: dust collection, cutting, and conveying. Of these systems, the on-board chain conveyor was found to be a dominant noise source. Noise generated by the conveying system was addressed through the development of a urethane-coated flight bar chain. The coated chain, shown in Figure 1, has demonstrated an 8-hour time-weighted average (TWA) reduction of operator exposure by 3 dB(A). It has since been accepted by the Mine Safety and Health Administration (MSHA) as a "technologically achievable" noise control for CMM operators who are exposed to noise that exceeds the MSHA permissible exposure level. Having demonstrated the noise reduction performance of the coated chain, NIOSH has assembled information into a business case that can be used by operations considering adopting the chain at their worksite.

Business Case

A business case is often used in organizations to assist rational decision-making about major initiatives. It facilitates systematic consideration of financial, organizational, and market perspectives. For occupational health and safety initiatives involving control technologies, a business case can encompass financial and organizational concerns alongside long-term health and safety outcomes. Although NIOSH and its partners have developed control technologies to reduce mine workers' overexposure to noise, implementation at the workplace has been impeded by slow industry acceptance and buy-in. Some of the slowness is due to a lack of readily available information needed to move forward with implementation. In some cases, there are real or perceived barriers. These are addressed below, followed by several drivers that can accelerate implementation of noise controls.

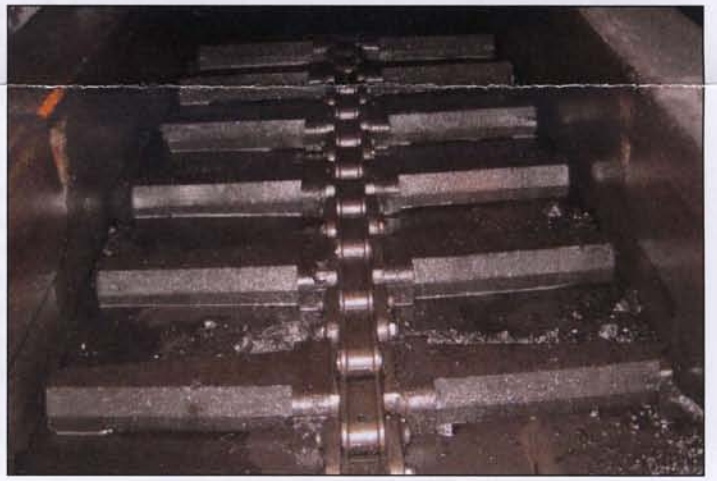

Figure 1.—Urethane-coated flight bar chain used in the conveyor system for a continuous mining machine.

Barriers

Financial expense: The perception that a noise control will increase costs is often used to defer investment in a control that might otherwise reduce health and safety risks. NIOSH worked with its industry partners when developing the coated chain to minimize any cost premium. The urethane-coated 38-inch conveyor chain produced by industry partner Cincinnati Mine Machinery costs 46% more than a standard single-sprocket

chain. As demand and sales increase, the additional production volume may allow the company to reduce the cost further until it is comparable to that of a standard chain. These cost differences may be offset through long-term gains in lowered workers' compensation costs and insurance premiums related to noise-induced hearing loss.

Unfamiliar maintenance: The negative perception of new or different maintenance procedures may inhibit companies from switching chains. In working with the chain manufacturer, NIOSH found that the urethane-coated chain does not require any new or unusual maintenance procedures that differ from the manufacturer's standard processes. Adhering to standard maintenance procedures (e.g., ensuring chain tension) will keep the urethane coating from wearing prematurely.

Unfamiliar installation: Even though the urethane-coated chain will fit on any CMM that has a standard 38- or 30-inch conveyor system, there may be a perception that chain installation will change. During field testing, NIOSH research found there were no differences between installing a standard or a coated chain. The urethane-coated flight bar chains are engineered as a direct replacement that requires no modification of the machine.

Variable conditions: Coal mine conditions can be highly variable, and there may be concerns that the urethane-coated chain cannot hold up in the more extreme conditions. To address these concerns, the coated chain was tested in the harshest conditions that could be found. It was placed in construction development and production sections that encounter exceptionally high wear and impact loads, including mining and conveying solid rock and construction debris. The coated chain worked successfully in these sections despite the harsh conditions.

Durability: New technologies or equipment often prompt questions about whether they are as durable as the current technology or equipment. For the urethane-coated chain, these questions centered on whether it has the same chain life as a standard single-sprocket, noncoated chain. The coated chain was field-tested in three U.S. mines in a wide variety of mining conditions. At these mines, the urethane-coated chain had the same replacement rate as the standard noncoated chain, meeting or exceeding the mines' expectations.

Drivers

Safety: Studies that investigated the link between noise and safety have found that workers whose daily noise exposures exceed 90 dB(A) have higher rates of single and multiple accidents. The risk is elevated for workers with normal hearing and is even higher for workers who have a hearing loss. Noise controls like the urethane-coated chain that reduce noise exposure can therefore also have a safety benefit.

Lower noise exposure: Another form of risk is the increased likelihood of a noise-induced hearing handicap or impairment. A NIOSH-developed model shows that a 65-year-old worker with 10 or more years of exposure will have a higher likelihood of a hearing impairment with higher average noise exposures (Table 1). So, for example, if the exposure can be reduced from 94 to 90 dB(A), 11 fewer workers out of 100 would acquire a noise-induced hearing impairment.

Table 1.—Excess risk of hearing impairment based on 8-hr time-weighted average sound level

8-hr TWA, dB(A)	Excess risk of hearing impairment, %
80	1.2
85	7.7
90	22.3
94	33.3
95	38.3
100	44.0

Lower stress: Reducing the noise exposure of CMM operators through the use of a urethane-coated chain will have an added benefit of lower workplace stress. Noise has been found to be a stressor that can interfere with concentration, causing errors and accidents. Stress is also linked to certain illnesses that can worsen absenteeism, reduce productivity, and increase insurance costs.

Lower workers' compensation costs: Workers' compensation insurance provides financial reparation to workers who sustain workplace injuries, fatalities, and occupational disease. The insurance companies make payments to the affected workers while the mining companies pay premiums to the insurers. The premiums a company has to pay can be indirectly affected by claims experience, along with other factors. During 2006–2009, the two most recognized workers' compensation insurance carriers for the U.S. coal mining industry received 92 claims filed for (nontraumatic) hearing loss compensation. Together, they paid nearly $750,000 in hearing loss claims.

Summary

The goal of this research is to reduce mine workers' overexposure to noise and ultimately reduce the number of workers who suffer from NIHL. Using a business case model can overcome the barriers and concerns that delay industry acceptance and use of control technologies such as the urethane-coated chain. The coated chain is part of a suite of controls developed by NIOSH and others that can reduce worker overexposure to noise. By assembling information into a business case model to challenge the barriers to industry acceptance, NIOSH is working to promote adoption of effective engineering noise controls.

For More Information

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