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ADMINISTRATIVE CONTROLS FOR REDUCING WORKER NOISE EXPOSURES

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ABSTRACT

Noise-Induced Hearing Loss (NIHL) continues to be a concern of the mining industry. A new noise standard (30 CFR, Part 62) is aimed at reducing NIHL in mining through engineering and administrative noise controls. However, the difficulty and expense of implementing engineering controls can make administrative controls an attractive alternative for reducing worker noise exposure. Over the last three years, the National Institute for Occupational Safety and Health (NIOSH) has conducted worker noise exposure surveys in underground and surface coal mines and coal preparation plants. The surveys revealed numerous possible administrative controls and an approach to implementation and analysis. The surveys have shown that worker dosimetry, time-motion studies, and equipment noise profiling are important aspects of effectively utilizing administrative controls. A description of the approach for selecting, implementing, and evaluating administrative controls, and a list of administrative controls, are reported.

INTRODUCTION

Prolonged exposure to noise can cause permanent damage to the auditory nerve and/or its sensory components. This damage, known as noise-induced hearing loss, is irreversible and makes it difficult to hear and understand speech. NIHL is the most common occupational disease in the United States today, with 30 million workers exposed to excessive noise levels (NIOSH, 1996a). The problem is particularly severe in mining, with studies indicating that by age 50, 70 to 90% of miners have NIHL large enough to be classified as a hearing disability (years of mining experience not considered in the analysis) (NIOSH, 1996b, 1997). In addition to government researchers, academics have reported that the "policies and practices for preventing occupational hearing loss among miners are inadequate. . there are deficiencies in nearly every sector: surveillance of exposure or of outcome, analysis, and intervention" (Weeks, 1995).

The Federal Coal Mine Safety and Health Act of 1969 established requirements for protecting coal miners from excessive noise. Subsequently, the Federal Mine Safety and Health Act of 1977 broadened the scope to include all miners, regardless of mineral type (the Acts are detailed in 30 CFR, 1997). Since the passage of these Acts, there has been some progress in controlling mining noise. However, data from more than 60,000 full-shift noise surveys conducted by the Mine Safety and Health Administration (MSHA) show that the percentage of coal miners with noise exposures exceeding federal regulations, and unadjusted for the wearing of hearing protection, was 26.5% and 21.6% for surface and underground coal mining, respectively (Seiler, Valoski, and Crivaro, 1994).

Despite the extensive work done in the 1970s and 80s, NIHL is still a pervasive problem (Federal Register, 1996). Therefore, MSHA has published new Health Standards for Occupational Noise Exposure (Federal Register, 1999). The new noise standard became effective on September 13, 2000. One of the changes is the adoption of a provision similar to OSHA's Hearing Conservation Amendment, where a miner must be enrolled in a hearing conservation program (HCP) if his full-shift noise exposure is at or above the action level of 85 dBA TWA_8, or 50% dose. MSHA projected in a 1994 survey that if an OSHA-like hearing conservation program were adopted, 78% of the coal miners surveyed would be required to be in a hearing conservation program (Seiler and Giardino, 1994). Other requirements of the new regulations are a Permissible Exposure Level (PEL) of 90 dBA TWA_8, no credit for the use of personal hearing protection, and the primacy of engineering and administrative controls for noise exposure reduction.

Administrative controls for reducing worker noise exposure have not been widely implemented in the mining industry for many reasons, including a lack of trained workers for efficient job rotation, union contract issues, and safety concerns. An understanding of implementation procedures and evaluation methods will hopefully lead to increased acceptance and implementation of administrative controls, and consequently, a reduction of worker noise exposure.

NOISE EXPOSURE REDUCTION APPROACHES

Several approaches can be taken to reduce noise exposure of workers in the mining industry, one of which might be to simply require workers to wear hearing protection. However, this may offer only a short-term and sometimes ineffective solution because of a variety of factors including: increased difficulty of hearing danger signals and warnings; the inconvenience or discomfort of wearing hearing protection; the potential for poorly fitting hearing protection; incorrect hearing protection selection for the noise levels present; etc. Studies have also shown that despite the availability of and presumed use of hearing protection, mine workers continue to experience NIHL. The continuance of NIHL among mine workers may be attributable to improper fit or usage of hearing protection, lack of knowledge concerning NIHL, training inadequacies, worker indifference, non-work activities, etc. In addition, recently enacted Part 62 noise regulations have eliminated the adjustment for the use of any hearing protector, requiring mine operators to implement all feasible engineering and administrative controls to reduce miner's noise exposure.

Another approach is to attack the source of the noise through redesign or modification of the machinery, equipment, or surrounding work area. Engineering controls, when feasible and properly applied, are the approach of choice. However, the cost of many engineering controls is high, as well as difficult or nearly impossible to implement due to the nature of the equipment, the facility, or mining process.

A third approach, which is the topic of this paper, is the use of administrative controls to reduce worker noise exposures. This term is used throughout MSHA's Health Standards for Occupational Noise Exposure; Final Rule (Federal Register, 1999). Administrative controls, as defined later, involve limiting the time that workers are exposed to noise through job rotation, task modifications, and increased noise hazard awareness. Through NIOSH's investigation

of worker exposures and noise source identification, various administrative controls were identified which might be used to reduce the noise exposure of mine workers. For instance, one study of a longwall stageloader operator revealed that he spent a considerable portion of his shift positioned at the belt tailpiece, which is one of the noisiest locations along the stageloader. By simply repositioning and standing back in the crosscut away from the stageloader and tailpiece when possible, his noise exposure could have been reduced by as much as 70%. The research also led to an approach for implementing and assessing the effectiveness of administrative controls.

ENGINEERING AND ADMINISTRATIVE CONTROLS - DEFINITIONS

30 CFR, Part 62.130 (a) Permissible exposure level states:

> "The mine operator must assure that no miner is exposed during any work shift to noise that exceeds the permissible exposure level. If during any work shift a miner's noise exposure exceeds the permissible exposure level, the mine operator must use all feasible engineering and administrative controls to reduce the miner's noise exposure to the permissible exposure level, and enroll the miner in a hearing conservation program that complies with § 62.150 of this part. When a mine operator uses administrative controls to reduce a miner's exposure, the mine operator must post the procedures for such controls on the mine bulletin board and provide a copy to the affected miner" (Federal Register, 1999).

To reflect these new standards, MSHA's policy now equally weighs engineering and administrative controls. Prior to the new regulations, all engineering controls had to be implemented before administrative controls could be put to use.

A clear understanding of what constitutes an engineering or administrative control is necessary before attempting to develop, implement, and/or analyze noise control techniques. There are many situations that can make classification of a control difficult. This is especially true when the control itself requires an engineering modification, but the requirement to use the control is administrative. One example is a control/quiet booth. From a technical standpoint, the booth is an engineering control, but requiring the worker to spend part of his shift in the booth is an administrative control. Although considerable overlap exists, in this study every attempt has been made to characterize each noise control as administrative or engineering, based on the definitions that follow

Engineering Controls are defined as:

> "Methods that reduce noise exposure by decreasing the amount of noise reaching the employee through engineering design approaches. Examples of engineering approaches include acoustic isolation or absorption, modification or replacement of equipment, modification of machine mounting, or changes to the structure housing the equipment. Engineering controls attempt to reduce noise at the source, interrupt the noise path, reduce reverberation, and reduce structure-borne vibration. Engineering controls isolate the noise from the worker through noise reduction" (adapted from NIOSH, 1996a).

Administrative Controls are defined as:

> "Methods that reduce exposure by limiting the time a worker is exposed to noise through administrative approaches. Examples of administrative approaches include rotation to lower noise areas, rescheduling tasks, modifying work activities, or increased hazard awareness. Administrative controls attempt to reduce worker exposure, limit the time of exposure, or distribute the exposure to other workers. Administrative controls isolate the worker from the noise by reducing exposure" (adapted from NIOSH, 1996a).

IMPLEMENTATION AND EVALUATION METHOD

The implementation and evaluation of an administrative control requires a thorough understanding of a worker's noise exposure, tasks, and possible noise sources. This is accomplished through full-shift worker exposure monitoring using a personal dosimeter (Figure 1), task observations (time-motion studies) to determine the amount of time the worker spends at various tasks and/or locations, then combining the dosimetry and task observations to estimate exposures for individual tasks/locations. It is essential that the task observations be as accurate and complete as possible. They can be conducted as a paper exercise (Figure 2) or by using a Personal Digital Assistant (PDA) and appropriate mobile data acquisition software (Figure 3). It is also necessary to collect representative noise level readings for each task/location (Figure 4).

Figure 1. Worker dose monitoring using a dosimeter.

Figure 2. Task observations, paper method.

Figure 3. Task observations using a PDA.

Figure 4. Example of noise measurement at a worker Location.

The exposure for a certain task or location can be determined in several ways. One method is to produce a cumulative dose plot from the dosimeter data, annotate the plot with the time-sequenced task observations, and estimate worker dose from the plot for the tasks of interest (Figure 5). When representative noise levels are available, the exposure can be calculated using the equation:

$$D=100\left(\frac{C_1}{T_1}+\frac{C_2}{T_2}+\ldots\frac{C_n}{T_n}\right) \quad (1)$$

where D = Noise dose, %;
C_n = Exposure time at a particular sound level, hr;
and T_n = Reference duration of exposure at the measured sound level, hr.

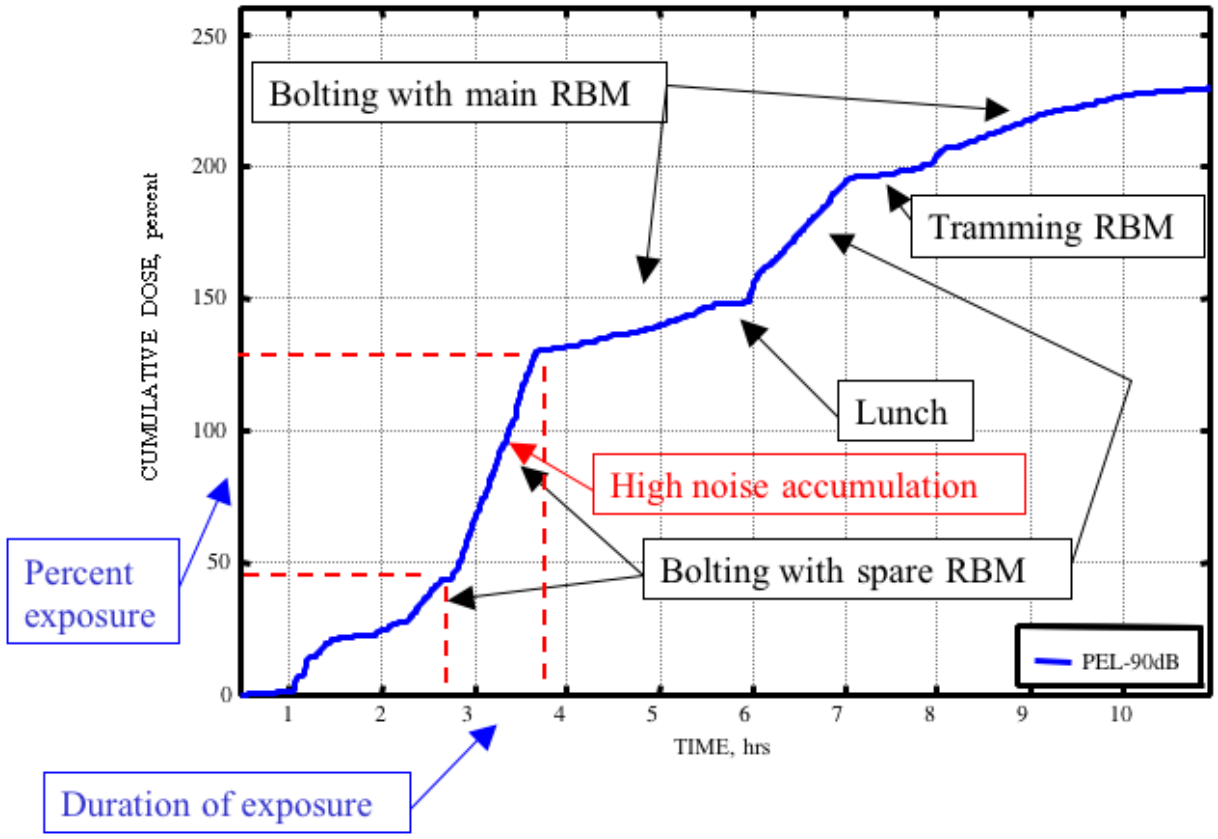

Figure 5. Cumulative dose plot for roof bolter operator.

The reference duration, T, can be found in the appendix to Part 62, Table 62-1 (Federal Register, 1999). For example, at a sound level of 95 dBA, T = 4.0 hrs. If exposure time is 4 hr, the calculated dose would be D = 100 (C_1/T_1) = 100 (4/4) = 100%. If the duration of exposure is reduced through an administrative control to 1 hr, the calculated dose would be D = 100 (1/4) = 25%.

The selection of administrative controls should be based on the periods of exposure that result in the largest dose, either because the duration time is long or the sound level is high, or a combination of the two. These periods of high noise exposure can be ascertained from either the cumulative dose plot (see Figure 5), a simple plot of LAVG noise levels (Figure 6), or by employing the calculation method listed above for each task.

After implementing the control, the worker's exposure must be re-measured and task observed to see if the worker followed the administrative control as prescribed and if the control reduced the worker's dose. Then, the reduction in exposure can be calculated by the above method, or a simple estimate of the success of the control can be made by calculating an overall (full-shift) percent dose reduction by the following equation:

$$S = \frac{Dose_I - Dose_P}{Dose_I} \times 100, \qquad (2)$$

where S = Reduction in dose (success of control), %;
$Dose_I$ = Initial (pre-implementation) full-shift dose, %; and
$Dose_P$ = Post-implementation full-shift dose, %.

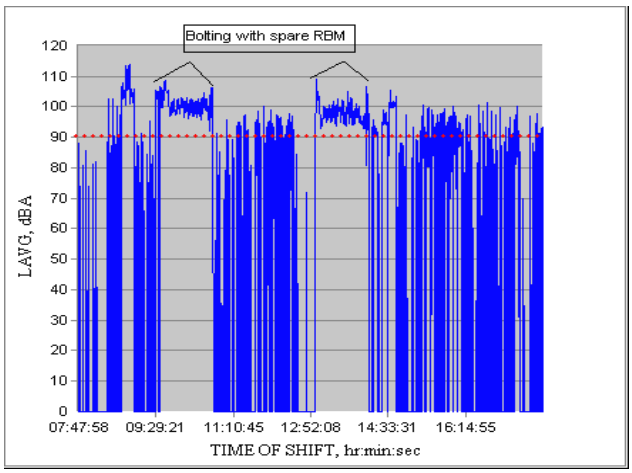

Figure 6. LAVG plot for roof bolter operator.

MSHA considers a 3 dBA reduction in a miner's noise exposure as feasible. Ultimately, an effective administrative control is one that reduces a worker's full-shift dose to less than 100%, or a TWA_8 of 90 dBA or less.

ADMINISTRATIVE CONTROL EXAMPLE

To illustrate the noise exposure reduction potential of an administrative control, the following example of a froth cell operator working in a coal preparation plant is presented. A cumulative dose plot of his full-shift exposure is shown in Figure 7 and illustrates that he spends a considerable portion of his shift on floor 2, mostly cleaning (hosing with water) around the froth cells where sound levels ranged from 92 to 101 dBA. Table 1 lists the calculated exposures for each of the floors and the general locations where he was observed working.

The following example illustrates how the calculated dose was determined using Equation 1. On floor 4, the worker was observed numerous times at three general locations: near the secondary froth cells (91 dBA); walking across floor 4 (avg. 95 dBA); and waiting near the elevator (93 dBA). Equation 1 becomes:

$$D = 100\left(\frac{0.42}{7} + \frac{0.0248}{4} + \frac{0.021}{5.3}\right) =$$

$$D = 100(0.06 + 0.006 + 0.004) = 7.02\%.$$

Note that the full-shift task/location-based calculated dose was less than the actual dose recorded by the dosimeter, approximately 11% less (182% vs. 206%). This is likely due to small errors in recording the times at each location because the froth cell operator continually changed locations and the variable sound levels at each location. Ultimately, the dosimeter more closely tracked the exposure level and time, although the manual calculation method gave a reasonable estimate of worker exposure.

In response to the above data, a logical administrative control would be to limit the froth cell operator's time on floor 2, since this is the floor where he would receive a majority of exposure. To simplify the analysis, a Leq average sound level of 97 dBA was used for all of floor 2. Table 2 lists the expected exposure reductions if the administrative control of limiting the worker's time on floor 2 were implemented. Table 2 illustrates that the worker would need to limit his time on floor 2 to under 1 hr to reduce his exposure to less than the MSHA PEL of 100%, while not increasing the time spent in other locations that have Leq sound levels greater than 90 dBA. In this case, this would be difficult to achieve because all floors have noise levels above 90 dBA, except the control room or lunch room; thus if the worker spent less time on floor 2 but more time on the other floors, his exposure still might not change significantly.

LIST OF ADMINISTRATIVE CONTROLS

Based on the noise surveys conducted at surface and underground coal mines and coal preparation plants, a list of administrative controls was developed. The list of controls came about through discussion with mine management and workers, the research team's observations, discussions with MSHA inspectors, and from later analysis of the noise data collected. It should be noted that no judgment has been made as to the feasibility of implementing any of these administrative controls and there are likely many more administrative controls than are listed here.

Although an economic evaluation of the controls was not performed, it appears that these controls may be far less costly and require less time to implement than engineering controls. Their cost to implement and their effectiveness would need to be determined on a case-by-case basis by the mine's management personnel. For instance, when employing job rotation to reduce worker noise exposure, a time/exposure analysis would need to be completed. This analysis would determine the total allowable time for each worker at a specific task, dictating when during the shift that rotation should occur. Likewise, the safety aspects would need to be carefully considered. These include the ability of workers to run other equipment or perform other tasks in a safe and efficient manner, and any additional training that may be necessary before workers can switch positions (i.e., operate different equipment) or perform different duties. In addition, any administrative noise control should not subject a worker to increased exposure from other hazards such as dust, or diesel fumes, or the overexposure of another worker to noise. Finally, implementing specific administrative controls is a subject for discussion between mine management and labor. The approach taken here is to simply list the administrative controls that may be applicable to the mining industry, presented by mine type, underground coal, surface coal, or coal preparation plant, and those applicable to all mining.

Underground Coal Mines

The administrative controls for underground coal mines were determined during noise surveys conducted in six underground coal mines located in AL, CO, PA, and WV. The administrative controls are listed first by their applicability to either continuous mining sections or longwall mining sections, and then by the specific categories of job switching/rotation, worker location, and equipment operation.

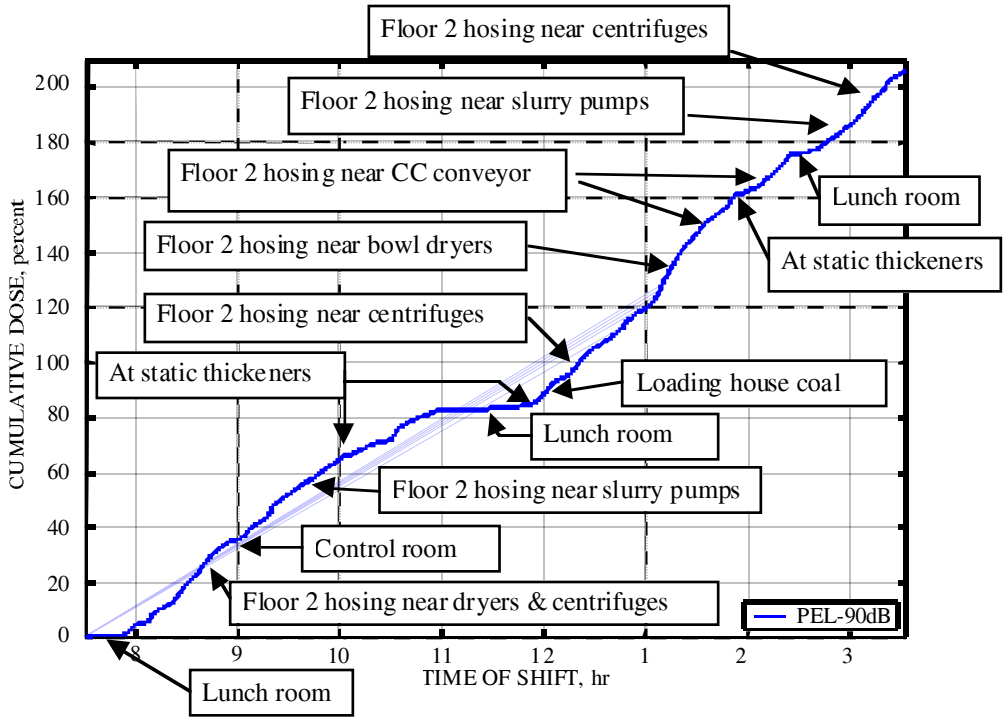

Figure 7. Cumulative dose plot for froth cell operator.

Worker Location	Duration, hr	Range of Noise, dBA	Number of Specific Locations, n	Calculated Dose[1,2], %
Floor 1	0.70	90 - 96	3	18.46
Floor 2	4.14	92 - 101	9	143.87
Floor 3	0.03	97	11	0.97
Floor 4	0.47	91 - 95	3	7.02
Floor 5	0.36	90 - 91	2	4.86
Elevator	0.32	83	1	1.38
Outside (Underflow)	0.28	92	1	4.53
Outside (Static Thickeners)	0.34	80	1	1.07
Lunch Room	1.25	72	1	0.00
Control Room	0.27	73	1	0.00
Total	**8.15**	----------	----------	**182.16**

Table 1. Location, duration, and calculated dose for froth cell operator, 03/27/01 (Actual Dose = 206.10%)

[1]Calculated using the equation $D=100\left(\frac{C_1}{T_1}+\frac{C_2}{T_2}+\ldots\frac{C_n}{T_n}\right)$ for each specific location and sound level on individual floors,

where C_n = time at specified sound level, hr; and

T_n = reference duration at specified sound level, hr.

[2]0% dose results from no dose being recorded because noise level was less than the MSHA Threshold Level of 80 dBA, and T_n = 0.

Table 2. Summary of exposure reduction for Froth Cell Operator after administrative control

Time on Floor 2, hr	Reference Duration T[1], hr	Calculated Dose[2], %	Percent Reduction[2,3], %	Estimated Shift Dose[4], %
4.14	3.0	138	0	206
3.0		100	38	168
2.0		67	71	135
1.0		33	105	101
0.0		0	138	68

[1]For an average sound level of Leq = 97 dBA.
[2]For floor 2 exposure only.
[3]Percent reduction gained by reducing worker's time on floor 2 to 3, 2, 1, and 0 hrs.
[4]Estimated total shift dose when time on floor 2 reduced, time on all other floors remains as listed in Table 1, and time subtracted from floor 2 spent in areas with low noise levels.

Room and Pillar Continuous Mining

JOB SWITCHING/ROTATION. The following administrative controls address either job switching or rotation of exposed workers in continuous mining sections.

• Switch high-exposure occupations with low- exposure occupations as follows:

1. Center bolter operator switch with center bolter helper;
2. Roof bolter operators switch with utility men or shuttle car operators;
3. Miner-bolter operator switch with loading machine operator;
4. Continuous miner operator switch with shuttle car operator.

WORKER LOCATION. The following administrative controls address the location of exposed workers in continuous mining sections.

• Relocate workers from high-noise locations to lower-noise locations as follows:

1. Locate shuttle car changeout point away from major noise sources such as the auxiliary fan;
2. Shuttle car operator should avoid idle parking in high-noise areas (e.g., pull away from feeder/breaker upon completing dumping);
3. Keep workers from congregating near auxiliary fans;
4. During maintenance, have the mechanics and electricians avoid working near high- noise sources and try to move work to a quiet area;
5. Utility man on continuous miner sections should minimize time working near face and auxiliary fan;
6. Locate lunch areas away from load centers and other noisy equipment.

EQUIPMENT OPERATION. The following administrative controls address equipment operation of exposed workers in continuous mining sections.

• Minimize noise exposure through quieter operation of equipment as follows:

1. Loading machine operator should back further away from the miner-bolter when not loading coal;
2. Minimize running chain conveyors that are empty on all equipment (i.e., shuttle car, loading machine, continuous miner, miner-bolter, and feeder-breaker);
3. Instruct continuous miner operator to stand as far back from the machine as possible while operating the CM by remote control;
4. Instruct roof bolters to drill straight holes and avoid contacting metal straps with the drill steel. This will eliminate the high- pitched screech;
5. Follow a cutting cycle that minimizes noise generation from both the continuous mining machine and the cutting process (i.e. reduce cutting into roof and floor rock, cutting directly into in-seam rock, and over sumping);
6. Regulate diesel engine RPM on diesel- powered shuttle cars during loading and dumping to minimize noise levels;
7. Follow shuttle car loading and tramming procedures that minimize noise (e.g., time that the conveyor chain is running, increase distance from continuous miner and its boom, etc.);
8. For loading machines, follow loading and tramming procedures that minimize noise exposure;
9. For any mobile equipment, turn off when not in operation.

Longwall Mining Sections

JOB SWITCHING/ROTATION. The following administrative controls address either job switching or rotation of exposed workers in longwall mining sections.

• Switch high-exposure occupations with low- exposure occupations as follows:

1. Head and tail shearer operators switch between each other during the shift;
2. Shearer operators switch with shieldman;
3. Stageloader operator switch with shieldman.

WORKER LOCATION. The following administrative controls address the location of exposed workers in longwall mining sections.

• Relocate workers from high-noise locations to lower-noise locations as follows:

1. Stageloader operator should minimize time in high-noise areas (e.g., crusher, motors and gears, head drive, belt tail, etc.);
2. Do not permit longwall face crew to sit at head drive. Crew should not congregate in high-noise areas;
3. Stageloader operator should eat lunch away from the stageloader to minimize noise exposure;
4. Locate dinner hole in quiet area away from stageloader;
5. Shieldmen should minimize their time at the head and tail drives;
6. Head drum shearer operator needs to stay a minimum of 3 m (10 ft) outby the head drum;
7. Tail drum shearer operator needs to move as far as possible from the tail drum, probably positioning himself in the middle of the shearer.

EQUIPMENT OPERATION. The following administrative controls address equipment operation of exposed workers in longwall mining sections.

• Minimize noise exposure through quieter operation of equipment as follows:

1. Minimize running face and stageloader conveyors when they are empty;
2. Minimize worker walk-by exposure to hydraulic pump cars. Move them into cross-cut or further down the track;
3. Minimize cutting of roof and floor rock.

Surface Coal Mines

The administrative controls applicable to surface coal mining were developed during noise surveys at eight surface mines located in AZ, ND, NM, TX, WA, and WY. Primarily dealing with the operation of draglines, the surface coal mine administrative controls are listed by the specific categories of job switching/rotation, equipment operation, and task modification.

JOB SWITCHING/ROTATION. The following administrative controls address either job switching or rotation of exposed workers in draglines.

• Switch high-exposure occupations with low- exposure occupations as follows:

1. Dragline oiler switch with dragline operator;
2. Dragline oiler switch with dozer operator/groundsman.

WORKER LOCATION. The following administrative controls address the location of exposed workers in draglines.

• Relocate workers from high-noise locations to lower-noise locations:

1. Limit dragline oiler and other workers' time in dragline house;
2. Limit dragline oiler time near Motor/Generator (MG) sets;
3. Limit dragline oiler time in revolving frame;
4. Limit mechanic's time repairing equipment in dragline house;
5. Employ remote sensing of grease levels, equipment temperatures, etc., and cameras to remove worker from noisy areas.

TASK MODIFICATION. The following administrative controls address task modification of exposed workers in draglines.

• Modify tasks such that workers are exposed to less noise as follows:

1. Perform cleaning in house when dragline is not in operation;
2. Perform maintenance in house when dragline is not in operation, if possible.

Coal Preparation Plants

Based on the noise surveys conducted at seven coal preparation plants, a list of administrative controls was developed. The preparation plants were located in KY, PA, VA, and WV. The controls are listed by the specific categories of job switching/rotation, equipment operation, and task modification.

JOB SWITCHING/ ROTATION. The following administrative controls address either job switching or rotation of exposed workers in coal preparation plants.

• Switch high-exposure occupations with low- exposure occupations as follows:

1. Plant operator switch with control room operator;
2. Inside mechanics switch with outside mechanics;
3. High-noise floor workers switch with low-noise floor workers;
4. In-plant workers switch with outside-plant workers.

WORKER LOCATION. The following administrative controls address the location of exposed workers in coal preparation plants.

• Relocate workers from high-noise locations to lower-noise locations as follows:

1. Limit plant worker time on noisy floors;
2. Limit plant worker time in or next to noisy equipment such as screens, crushers, centrifuges, and dryers;
3. Relocate work stations/controls to quieter locations;
4. Employ remote sensing of plant operating levels and cameras around equipment operation to move worker to quiet area;
5. Move pulp density measuring to quiet location;
6. Relocate tool boxes, cabinets, and supplies to quiet area.

TASK MODIFICATION. The following administrative controls address task modification of exposed workers in coal preparation plants.

• Modify tasks such that workers are exposed to less noise as follows:

1. Operate noisy equipment/processes (welding, grinding, etc.) when fewer workers will be exposed;
2. Perform maintenance on noisy equipment when plant is down, if possible.

All Mining

The following list of administrative controls appears to be applicable to coal mining in general and other mining types as well.

• Provide noise source awareness training as follows:

1. Provide training in noise source awareness to foreman and mechanics;
2. Teach/emphasize noise awareness to all workers;
3. Training in awareness and consequences of NIHL and recognizing high-noise areas;
4. Label high-noise areas with signs to identify the danger;
5. Post signs and warning lights/alarms in high-noise areas.
6. Supervisory enforcement of noise reduction requirements and discipline for those who fail to comply.

• Minimize noise exposures as follows:

1. Keep workers from congregating at high- noise areas;
2. Minimize exposure of foremen to high-noise sources during the shift;
3. Switch/rotate workers from high- to low- noise exposure jobs/occupations;
4. Designate low-noise walkways;
5. Eliminate tasks that are unnecessarily noisy;
6. Provide training to complete tasks more quickly and efficiently;
7. Modify work activities to shorten time or decrease noise level;
8. Relocate work stations/controls to quieter locations;
9. Employ remote sensing and cameras in noisy areas to allow worker to move to quiet area;
10. Require workers to use quiet rooms/areas/booths during break times;
11. Require workers to maintain quiet rooms (e.g., closed doors and windows, caulking and weather-stripping);
12. Operate noisy equipment or complete noisy tasks during periods when fewer workers will be exposed.

Controls Which May Be Both Administrative and Engineering In Nature

The following list of controls may be both administrative and engineering-related in nature in that the control is engineering while the requirement to use it is administrative.

- Buy the quietest equipment available;
- Properly maintain all equipment to help reduce excessive noise resulting from lack of oil or grease, parts wearing out, and maintain and grease rollers, bearings, hubs, etc.;
- Provide sound-treated booths and require the worker to use them periodically;
- Locate noise sources away from normal travelways;
- Counsel/instruct miners on proper use, operation, and maintenance of equipment with noise control devices/features.

HEARING PROTECTION

When noise control measures are not feasible, do not reduce exposures below the PEL, or until such time as they are installed or implemented, hearing protection devices (HPDs) are the only way to prevent hazardous levels of noise from damaging the inner ear. Making sure HPDs are worn effectively requires continuing attention on the part of supervisors and mine management, as well as noise-exposed employees (NIOSH, 1996a). From the list of HPD-related concerns presented in NIOSH, 1996a, pp. 70-71, a selective representation is listed:

- Provide regular maintenance or replacement of hard-hat-mounted muffs;
- Make sure hard-hat-mounted muffs are properly fitted and used;
- Provide training in proper wearing and fit, and in recognizing when hearing protection needs to be replaced;
- Regularly replace other muff types and plugs;
- Consider developing a policy on when to wear hearing protection (such as upon leaving the mantrip, leaving the dinner hole, entering plant, or whenever sound levels exceed 85 dBA);
- Provide employees the opportunity to select from a variety of HPDs;
- Regularly evaluate effectiveness of hearing protection program.

SUMMARY

The use of administrative controls to reduce worker noise exposure, and subsequently NIHL, can play a key part in complying with the new MSHA noise standards, 30 CFR, Part 62. The successful use of administrative controls can be greatly enhanced by employing the implementation and evaluation procedure detailed in this report. This includes conducting full-shift dosimetry, task observations, and sound level determination of worker tasks and locations.

It should be noted that the list of administrative controls provided here is not all-inclusive. Also, the controls have not been proven as to their economic feasibility and provide only a starting point for considering appropriate administrative controls on a case-by-case basis.

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