Mining Equipment Noise

Eric R. Bauer, Mining Engineer

National Institute for Occupational Safety and Health (NIOSH)

Pittsburgh Research Laboratory

Hearing Loss Prevention Section

Health Branch
Presentation Outline

• Review of current NIOSH noise research
• New MSHA noise regulations
• Hearing loss among miners
• Underground noise measurements
Hearing Loss Research

- **Ongoing NIOSH projects**
  1. Cross-Sectional Survey: Noise Exposure Patterns/Sources
  2. Engineering Controls for Hearing Loss Prevention
  3. Health Hazards Study of Surface Drilling Operations
  4. Model Hearing Conservation Program for Miners
  5. Intervention Through Education and Training to Prevent Hearing Loss
  6. Definition and Assessment of Engineering Noise Controls
MSHA Noise Regulations

- Effective date - Sept. 13, 2000
- Permissible Exposure Level of 90 dBA TWA, 5 dB Exchange Rate, Slow Response, 90–140 Range
- Action Level (Hearing Conservation) of 85 dBA, 5 dB Exchange Rate, Slow Response, 80–130 Range
- Primacy of Engineering and Administrative Controls
Work-Related Hearing Loss

- 30 million US workers exposed to excessive noise levels.
- Noise-induced hearing loss is the most common occupational illness.
- 3.3 million workers in mining and construction exposed to damaging noise (50-90% hearing disabled by age 50).
Hearing Loss in Miners
Cross-Sectional Survey of Noise Exposure in the Mining Industry

NIOSH
Pittsburgh Research Laboratory
Health Branch
Objective

We want to know

< What are miners’ doses

and

< What contributes to miners’ doses.

Then we can focus engineering and administrative control efforts where it will make the biggest difference.
Is there a Problem?
Measurement Plan

✓ Worker monitoring with dosimeters – Worker noise exposure/dose

✓ Task observation – Determine worker tasks and equipment operations responsible for exposures

✓ Equip. noise profiling using SLMs – Pinpoint contributions to worker noise exposure
Instrumentation

1. Quest Q400 Dosimeters – Worker dose
2. Quest 2900 Sound Level Meters – Equip. noise
3. B&K 2900 Investigator – Octave band analysis
Underground Coal Surveys

1. Four, underground coal mines, operating in the Pittsburgh seam (WV), Wadge seam (CO), Lower Cedar Grove seam (WV), and Alma A seam (WV)
   - Three CM sections
   - Three LW sections
Longwall Surveys

1. Range of equipment noise levels
2. Noise contour plots
3. Worker dose
4. Cumulative dose plots
<table>
<thead>
<tr>
<th>Equipment</th>
<th>Range, dBA</th>
<th>Location of Highest Noise Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stagelader</td>
<td>84–102</td>
<td>Head drive, crusher, gear boxes, bridge conv.</td>
</tr>
<tr>
<td>Shearer</td>
<td>85–99</td>
<td>Adjacent to drum</td>
</tr>
<tr>
<td>Hyd. Pump Car</td>
<td>78–99</td>
<td>Motors and pumps</td>
</tr>
<tr>
<td>Panline</td>
<td>78–91</td>
<td>Near head drive</td>
</tr>
<tr>
<td>Head Drive</td>
<td>89–96</td>
<td></td>
</tr>
<tr>
<td>Tail Drive</td>
<td>92–94</td>
<td></td>
</tr>
<tr>
<td>Dinner Hole</td>
<td>&lt;60–90</td>
<td>Next to stagelader</td>
</tr>
</tbody>
</table>
Shearer (cutting to tail)
Shearer (cutting to head)
Stage Loader

**KEY**
- B: 48 in Belt
- TP: Belt Tail Piece
- BC: Bridge Conveyor
- CP: Control Panels
- OL: Operators Location
- C: Crusher
- CC: Chain Conveyor
- HD: Head Drive

Leq, dBA
Stageloader
Longwall Hydraulics

KEY
M - Motor
P - Pump
BS - Block Stopping

Leq, dBA
Longwall Hydraulics
General Observations - LW

1. Noise levels consistent for similar equip. found in each mine
2. Stageloader had highest noise levels
3. Head drive and BC motor area noisy
## Longwall Worker Dose

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Range of PEL Dose, %</th>
<th>No. of Shifts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shearer Operator</td>
<td>124–786</td>
<td>18</td>
</tr>
<tr>
<td>Headgate Operator</td>
<td>142–386</td>
<td>6</td>
</tr>
<tr>
<td>Jacksetter/Shieldman</td>
<td>49–192</td>
<td>25</td>
</tr>
<tr>
<td>Electrician/Mechanic</td>
<td>37–156</td>
<td>13</td>
</tr>
<tr>
<td>Foreman</td>
<td>61–203</td>
<td>6</td>
</tr>
</tbody>
</table>
Cumulative Dose, Headgate Operator

- Mantrip out
- Working near head drive
- Equipment idle
- At shield 10, conveyor full
- Mantrip in

TIME OF SHIFT, hrs

CUMULATIVE DOSE, percent

PEL – 90 dB
CM Surveys

1. Range of equipment noise levels
2. Noise contour plots
3. Worker dose
4. Cumulative dose plots
## Range of Noise Levels – CM

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Range, dBA</th>
<th>Location of Highest Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Miner</td>
<td>78–109</td>
<td>Near tail</td>
</tr>
<tr>
<td>Miner/Bolter</td>
<td>92–103</td>
<td>Near drill stations</td>
</tr>
<tr>
<td>Roof Bolter</td>
<td>84–112</td>
<td>Near drill stations</td>
</tr>
<tr>
<td>Shuttle Car</td>
<td>78–89</td>
<td></td>
</tr>
<tr>
<td>Feeder/Breaker</td>
<td>81–97</td>
<td>Discharge end</td>
</tr>
<tr>
<td>Auxiliary Fan</td>
<td>84–120</td>
<td>Exhaust</td>
</tr>
</tbody>
</table>
Roof Bolting Machine

![Diagram showing the noise levels around the roof bolting machine.](image)
Center Bolting Machine
Miner Bolter (Cutting)
Miner Bolter (Bolting)
Auxiliary Fan

The diagram shows the sound level distribution (Leq, dBA) around a 75 hp Fan. The sound levels are color-coded, with darker colors indicating higher sound levels. A 'Curtain' is also indicated on the diagram.
Feeder/Breaker
Feeder/Breaker

48 in Belt

Pick Breaker Motor and Pump

Leq, dBA
General Observations -CM

1. Noise levels varied for similar equip. found in each mine
2. Auxiliary fan had highest noise levels
3. Drilling also noisy
<table>
<thead>
<tr>
<th>Occupation</th>
<th>Range of PEL Dose, %</th>
<th>No. of Shifts</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM Operator</td>
<td>48–323</td>
<td>7</td>
</tr>
<tr>
<td>Roof Bolter Operator</td>
<td>57–247</td>
<td>13</td>
</tr>
<tr>
<td>Shuttle Car Operator</td>
<td>9–165</td>
<td>20</td>
</tr>
<tr>
<td>Electrician/Mechanic</td>
<td>19–162</td>
<td>9</td>
</tr>
<tr>
<td>Utility/Scoop Operator</td>
<td>19–297</td>
<td>12</td>
</tr>
<tr>
<td>Foreman</td>
<td>17–232</td>
<td>9</td>
</tr>
</tbody>
</table>
Cumulative Dose Plot, Roof Bolter Operator

- Bolting with main RBM
- Tramming RBM
- Lunch
- Bolting with spare RBM

TIME, hrs

CUMULATIVE DOSE, percent

PEL-90dB
NIOSH – Pgh. Research Lab

Hearing Loss Prevention Section

Eric R. Bauer, Ph.D., P.E.
Mining Engineer
(412) 386–6518
ebauer@cdc.gov