Overview

Purpose: Compare noise levels of battery-powered vs. gas-powered landscaping equipment to assist in making purchasing decisions

- Visited a resort hotel facility
- Performed area sound level measurements and dosimetry for two different hedge-trimming crews
  - One using battery-powered equipment
  - The other using gasoline-powered equipment
- Discussed noise exposure and other concerns with management

Methods

Grounds maintenance crew:
- Two workers operating hedge-trimmers
- One worker operating a blower
- One worker occasionally collecting the trimmings
Methods - Dosimetry

- Estimate noise dose accumulated over a work shift
  - Dosimeters (Larson Davis Spark model 706RC) collected data with both OSHA (90/5) and NIOSH (85/3) exchange rates
  - Calibration before and after use.
- In each group of workers, a dosimeter was worn by the operator of a blower and the operator of a hedge-trimmer.
- Short sample from a gas-powered riding mower

Methods – Sound Level Meter Measurements

SLM measurements were taken to estimate the levels experienced by both workers and bystanders
- Apple iPhone 5S with a Mic-W Lightning Microphone and NIOSH SLM app
- Larson Davis 831
- Leica Disto E7400X Laser Distance Meter - used to determine distances from the SLM to the noise source

Methods – Feedback from Management

- Discussed evaluation criteria for new equipment purchase, particular advantages and disadvantages of various models
- Workers also weighed-in on their equipment preferences
Results - Dosimetry

- Dosimeters ran for about 5 hours.
- A typical shift is 8 hours, including:
  - set-up at the start of the shift
  - clean-up at the end of the shift
  - lunch break
  - bathroom or water breaks
  - quiet periods when workers were changing locations, or using manual tools (rake or shovel)
- Other noise sources:
  - gas-powered generator powering lights - near the crew using gasoline-powered equipment
  - another crew of workers mowing in the vicinity
  - light vehicle traffic

Dosimetry Results

<table>
<thead>
<tr>
<th>Power Source</th>
<th>Tool</th>
<th>Dose (%)</th>
<th>TWA (dBA)</th>
<th>Projected Dose (%)</th>
<th>8-hour TWA (dBA)</th>
<th>Projected Dose (%)</th>
<th>8-hour TWA (dBA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery</td>
<td>Blower</td>
<td>5</td>
<td>72</td>
<td>8</td>
<td>60</td>
<td>30</td>
<td>81</td>
</tr>
<tr>
<td></td>
<td>Trimmer</td>
<td>8</td>
<td>76</td>
<td>15</td>
<td>72</td>
<td>66</td>
<td>85</td>
</tr>
<tr>
<td>Gas</td>
<td>Blower</td>
<td>121</td>
<td>95</td>
<td>194</td>
<td>91</td>
<td>1448</td>
<td>99</td>
</tr>
<tr>
<td></td>
<td>Trimmer</td>
<td>60</td>
<td>90</td>
<td>94</td>
<td>86</td>
<td>730</td>
<td>92</td>
</tr>
</tbody>
</table>

- Gas-powered riding mower – Leq of 99 dBA for a 5-minute sample
- Note: these are protected exposures, workers were all wearing hearing protection

Projected Dose (%) – NIOSH and OSHA Criteria

- Gas-powered riding mower – Leq of 99 dBA for a 5-minute sample
- Note: these are protected exposures, workers were all wearing hearing protection
SLM Results

<table>
<thead>
<tr>
<th>Noise Source</th>
<th>Position</th>
<th>SLM</th>
<th>LAeq (dB(A))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery-powered trimmer A</td>
<td>Hearing zone</td>
<td>NIOSH App</td>
<td>82</td>
</tr>
<tr>
<td>Battery-powered trimmer B</td>
<td>Hearing zone</td>
<td>NIOSH App</td>
<td>79</td>
</tr>
<tr>
<td>Battery-powered Blower</td>
<td>Hearing zone</td>
<td>NIOSH App</td>
<td>85</td>
</tr>
<tr>
<td>Battery-powered Blower</td>
<td>5-15 feet away</td>
<td>NIOSH App</td>
<td>83</td>
</tr>
<tr>
<td>Battery-powered trimmers (A &amp; B)</td>
<td>About 15-30 feet away</td>
<td>NIOSH App</td>
<td>78</td>
</tr>
<tr>
<td>Gas-powered Blower</td>
<td>36 feet away</td>
<td>NIOSH App</td>
<td>78</td>
</tr>
<tr>
<td>Gas-powered trimmers and Blower</td>
<td>15 - 20 feet away</td>
<td>NIOSH App</td>
<td>87</td>
</tr>
<tr>
<td>Gas-powered generator for lights</td>
<td>2 feet away</td>
<td>LD831</td>
<td>91</td>
</tr>
</tbody>
</table>

Feedback from workers and management – Safety

- Management would like to reduce noise levels enough to eliminate need for hearing conservation program
- Battery-powered trimmers can improve ergonomics - workers find battery-powered hedge trimmers much lighter (11.4 lbs. vs. 15.4 lbs + fuel, according to manufacturer website)
- Battery-powered equipment doesn’t produce exhaust which improves comfort, and potentially health

Feedback from workers and management – Quality of Grounds

- Battery-powered blowers work at least as well as their gasoline-powered counterparts
- Battery-powered trimmers work as well as gas-powered, except when the hedges have thick-diameter foliage
Feedback from workers and management – Economic Feasibility

- Battery life needs to last for an entire work shift
- Battery-powered equipment would need last as long as gas-powered equipment before needing replacement (about 18 months) – still TBD
- Cost of maintenance is an issue – battery-powered trimmers fail more frequently than gas-powered versions

How Reliable/Consistent are the data?

- That day only
- Not a whole shift (cut short for logistical reasons)
- Sound Level Measurements don’t have statistical significance
  - We wish we’d taken more of these!
- Occasional background noise (gasoline powered generator)
- Data are not sufficient to determine dose or to meet any OSHA requirements

So What are the Data Good For?

- Along with other factors, incredibly useful for making a low-stakes power-tool purchasing decision
- Noise – just one factor among many in decision making for company
- No/low risk for results being imprecise
  - Worst case scenario if they are wrong/change.
- The supervisor could have made sound level measurements very easily
Recommendations to the Company

1. Keep up the good work in considering noise levels when purchasing equipment
   • SAE Standard AS6228 – "Safety Requirements for Procurement, Maintenance and Use of Hand-held Powered Tools" (SAE International, 2018)

2. Consider evaluating other hazards
   • Ototoxic (gasoline, exhaust fumes)
   • Noise > other health outcomes (Cardiovascular health, depression, tinnitus, etc.)

3. Consider applying for the Safe-in-Sound Excellence in Hearing Loss Prevention Awards™

Broad Picture Takeaways

1. Buy-Quiet has a problem that on-site user-friendly sound level measurements can fix
2. The resulting data should be sufficient to make low-risk purchasing decisions
3. Must be careful to not improperly use the data
   1. Not adequate for dose
   2. Not adequate for correctly choosing hearing protection

Next Steps for NIOSH

1. Develop and promote SLM field-testing ‘best practices’

2. Research to show viability/practicality of routinely using standardized field-testing ‘best practices’

3. Research on the viability/practicality of instituting Buy-Quiet programs based resulting data

4. Ultimate dissemination plan: NIOSH Science Blog, social media campaign to raise awareness, best practices, industry publications
THANK YOU!!

Questions/Discussion as time permits

For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-222-6348  www.cdc.gov

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention.