

NORA Construction Sector Council Meeting

Washington, DC

November 28~~29~~, 2023

Title: NIOSH Noise Control Project

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Overview

- Noise is a problem in construction
- Hierarchy of Controls
- Prevention through Design (PtD)
- Sell and Buy Quiet
-

Prevention through Design (PTD)

- Design out hazards to workers
- Redesign and retrofit new and existing equipment and work processes
- Prevent or reduce occupational injuries, illnesses, and fatalities
- Sell and Buy Quiet focusses on preventing noise exposure

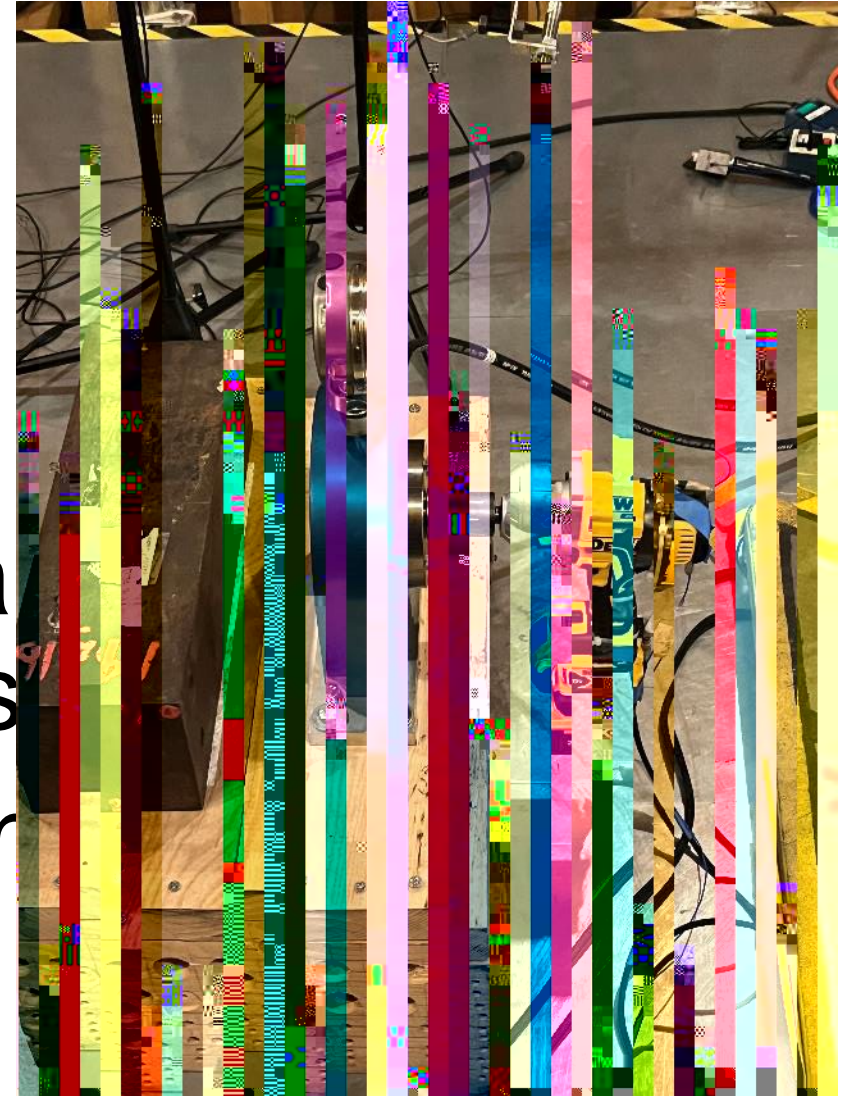


Photo Credit (NIOSH)

Hierarchy of Controls

Most effective

Elimination

Replace noisy equipment

Substitution

Design quiet equipment
Remove hearing hazards

Engineering Controls

Administrative Controls

Change the way people work

PPE

Personal Protective Equipment

Least effective

Image by NIOSH

<https://www.cdc.gov/niosh/topics/hierarchy/>

Sell and Buy Quiet

Replace the noisy tools with the quieter tools.

Make sure all the important factors are considered.

Tool Type (Number of Tools)	Sound Power		Average	Average
	L_{WA}	L_{WA}	Noise Exposure	Percent
	Max	Min	Reduction	Reduction
	dBA	dBA	dBA	%
Miter Saw (6)	113	103	10	90
Circular Saw (38)	113	104	9	87
Reciprocating Saw (23)	112	102	10	90
Impact Wrench (11)	111	101	10	90
Grinder (34)	109	95	14	96

Generalizing Sell and Buy Quiet is the solution

- Hearing loss occurs and interacts simultaneously with many other factors
- All health, safety, and cost factors are considered
- SAE International Aerospace Standard AS6228
Safety Requirements for Procurement, Maintenance and Use
Handheld Powered Tools
 1. Measure the factors
 2. Convert factors into subscores
 3. Choose importance weights from 0.5 to 2 for each factor
 4. Sum weighted subscores yielding total life cycle scores
 5. Sort the power tools models by descending life cycle score

SAE AS6228 Safety Procurement Standard

Table is adapted from Zechmann 2018
HigherLife Cycle Scores are better

Overview of Life Cycle Scores

- 1) Identify the tool type for the task to be completed
- 2) Research the current state of the technology for the tool
List the important factors to consider when making a purchase
- 3) Research reputable manufacturers that produce the tool
List promising models of tools for data collection
- 4) Use the life cycle formula to calculate the life cycle score for each model
- 5) List the tools by descending life cycle score and select as a buying tool to best complete the identified task in the safest manner possible

107 dBA



108
dBA



110
dBA

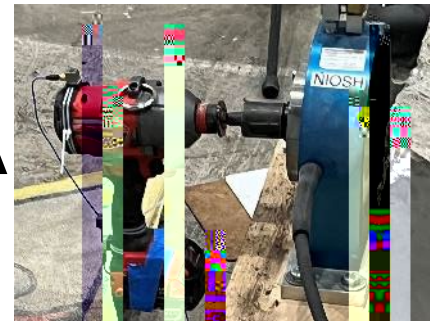


Photo Credit (NIOSH)

Research the current state of technology

- Perform a technical information search on the type of equipment to understand the current state of the technology available.
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Life Cycle Score Step 3

Research reputable manufacturers

- Do a search to identify the manufacturers. Make a list of reputable manufacturers. Do a search to identify search engines, shopping search engines, and shopping websites. Make a list of those internet resources that include the important factor information.
- Use a search engine to find manufacturers. There are websites that have lists of manufacturers.
- There are business review websites which may be helpful for assessing manufacturers, sellers, and other companies in the business chain.

Use the life cycle formula to calculate

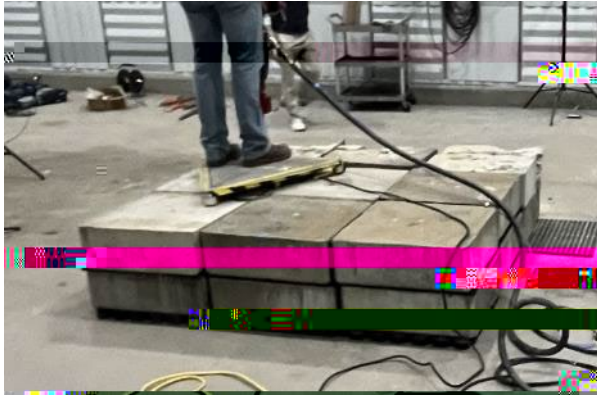
- Make a spreadsheet which has the important factors in the columns and has power tools the rows.
- Fill the spreadsheet with the factor data.
- Use piecewise linear, logarithmic, and exponential scaling formulae to convert the measured factors to subscores from 1 to 10.
- Identify the weighting for each factor from 0.5 to 2 based on relative importance of the factors.
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- Sort the list power tools by descending life cycle score.
- Choose a power tool that is close to the top of the indexed product

Impact Wrench	Energy
Mask Number	

Jack Hammers Testing

Test Setup



No Controls



All Controls



Photo Credit (NIOSH)¹⁷

Jack Hammers

Framing Nailers Lack of Noise Data

EN 12549:1999 is the standard for measuring fastener tool noise

- Sound power data was NOT found on US manufacturers websites or manual
- Sound power data was found on European manufacturers websites and man
- A-weighted sound power does not fit the hearing loss model sufficiently well for impulsive noise
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Future Work

- Further develop noise controls for Jack Hammers
- Publish Life Cycle Scores on Impact Wrenches, Leaf Blowers, Light Towers
- Estimate the Life Cycle Scores for Framing Nailers
- Develop a better noise metric for impulsive noise
- Publish a Blog on “Sell and Buy Quiet”
- Publish a Blog on “Life Cycle Scores”
- Publish a journal article on calculating Life Cycle Scores

Acknowledgements

Pittsburgh Research Mining Division Cincinnati Division of Field Studies

- Support for testing jack hammers, leaf blowers, and impact wrenches, and Engineering
- Support for data collection and testing a light tower, jack hammers, leaf blowers, and impact wrenches

Timothy Beck

Jacob Carr

Jason Driscoll

Yousef Elmashae

Johnathan Hrica

Brandin Lambie

Curtis Robinson

Lincan Yan

David Byrne

Wei Gong

Curtis Orme

Todd Painter

Shawn Ubrey

Questions

- Noise Controls
- Prevention Through Design (PtD)
- Sell and Buy Quiet
- Life Cycle Scores SAE AS6228

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