Weapon Noise Assessment

Why routine dosimetry doesn't work

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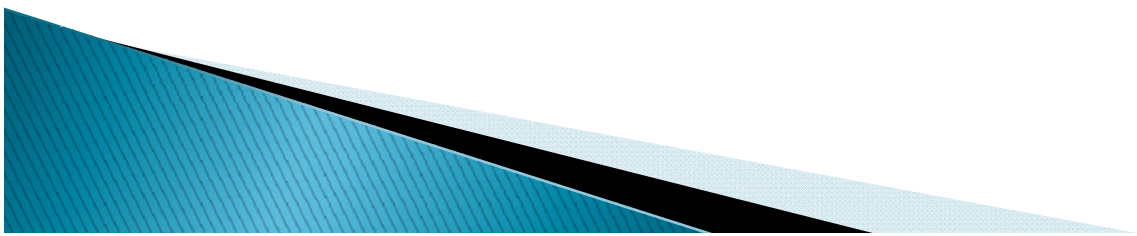
Industrial Hygiene

- Is our job only to document hearing loss???

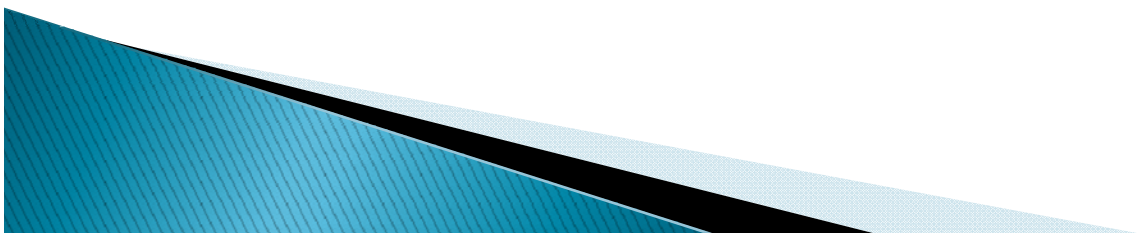
Overview

- Objective
- Background
- The Team
- Types of Noise
- Characteristics of Weapon Fire
- Data Comparison
- Future Studies
- References
- Questions



Objective

- Raise awareness to the limitations of personal noise dosimeters



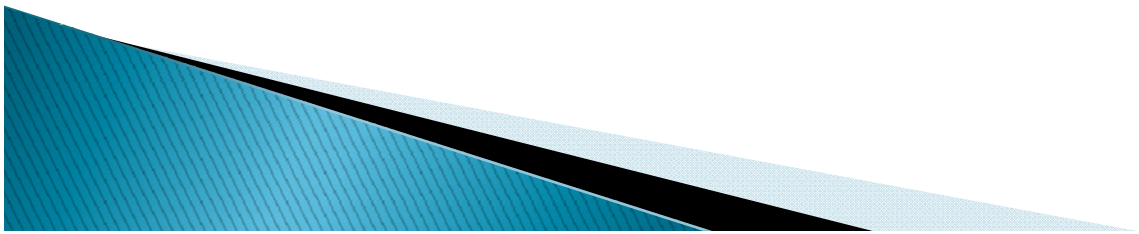
Background

- NIOSH and other health researchers have documented the inadequacy of using personal noise dosimeters to measure impulse noise during weapons firing.

- Our study is in the process of characterizing impulse noise from a variety of military issue firearms at indoor and outdoor firing ranges.

The Team

- Scott McFeeters, Industrial Hygienist
- Jane Nowell, MS, CIH
- Leif Olsen, MPH, CIH
- Tom Hartsog, Industrial Hygiene Technician
- Michelle Dewitt, Industrial Hygiene Technician

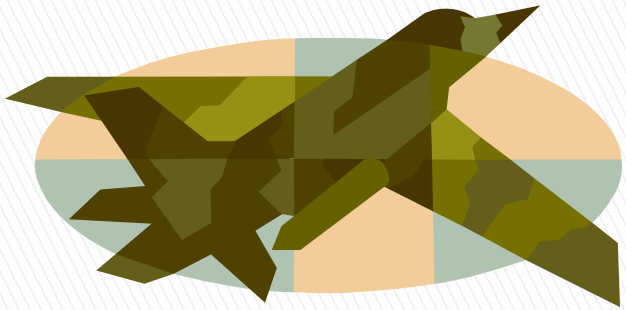


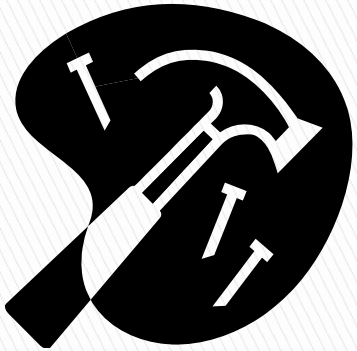
Impulse? Impact? Peak? Noise

- Impulse, impact, peak are often used interchangeably
  - Short
  - High frequency
- Less than 1 sec in duration
  - May$_{re}$ peat after delay of 1 sec

Continuous vs. Impulse Noise

- Continuous noise: industrial machinery, aircraft and auto engines, landscaping equipment, etc.
- Impulse noise: door slamming, automobile backfire, weapon firing, riveting, drop forging, etc.



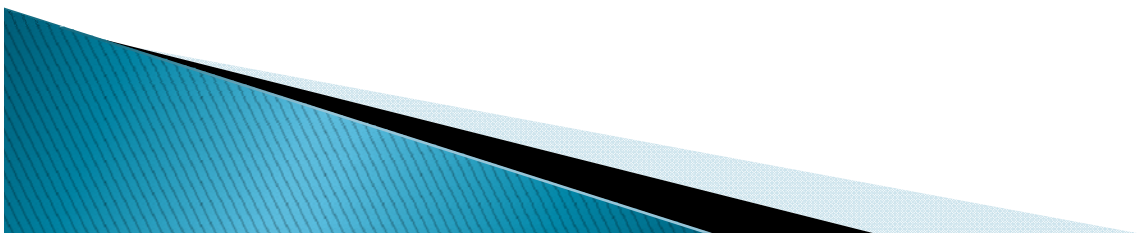


Weapon Fire Characteristics

- Rapid
- Short duration
- Large change in instantaneous sound pressure level
  - Rapid expansion of gas
- Impulsive Noise

DoD Instruction 6055.12

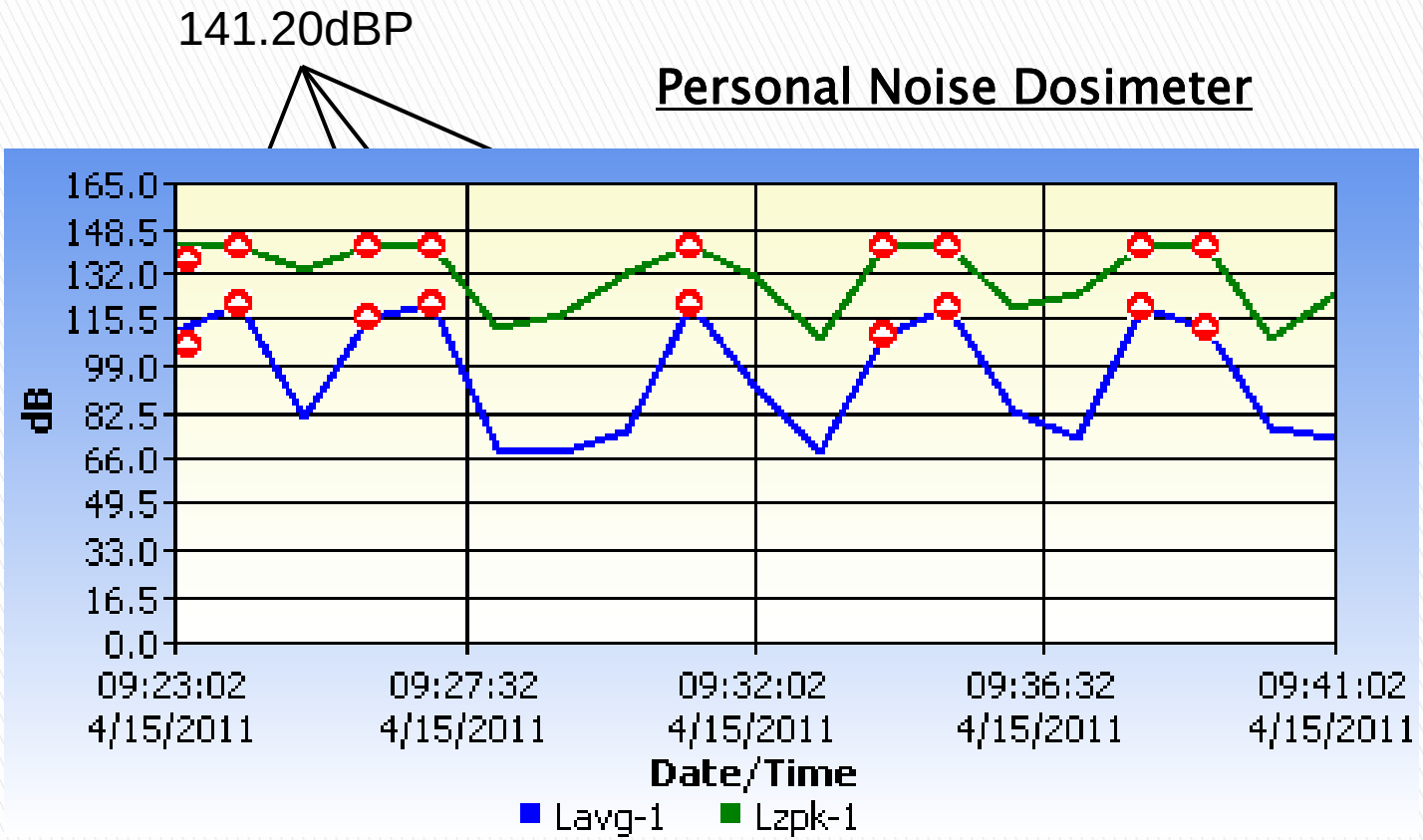
- i. Measure impulse noise levels using calibrated SLMs that:
  - (1) Meet or exceed specifications in Reference (i).
  - (2) Have a peak hold circuit.
  - (3) Have a rise time not exceeding 35 microseconds.
  - (4) Are capable of measuring peak SPLs in excess of 140 dB peak SPL.



Weapon Noise Profile

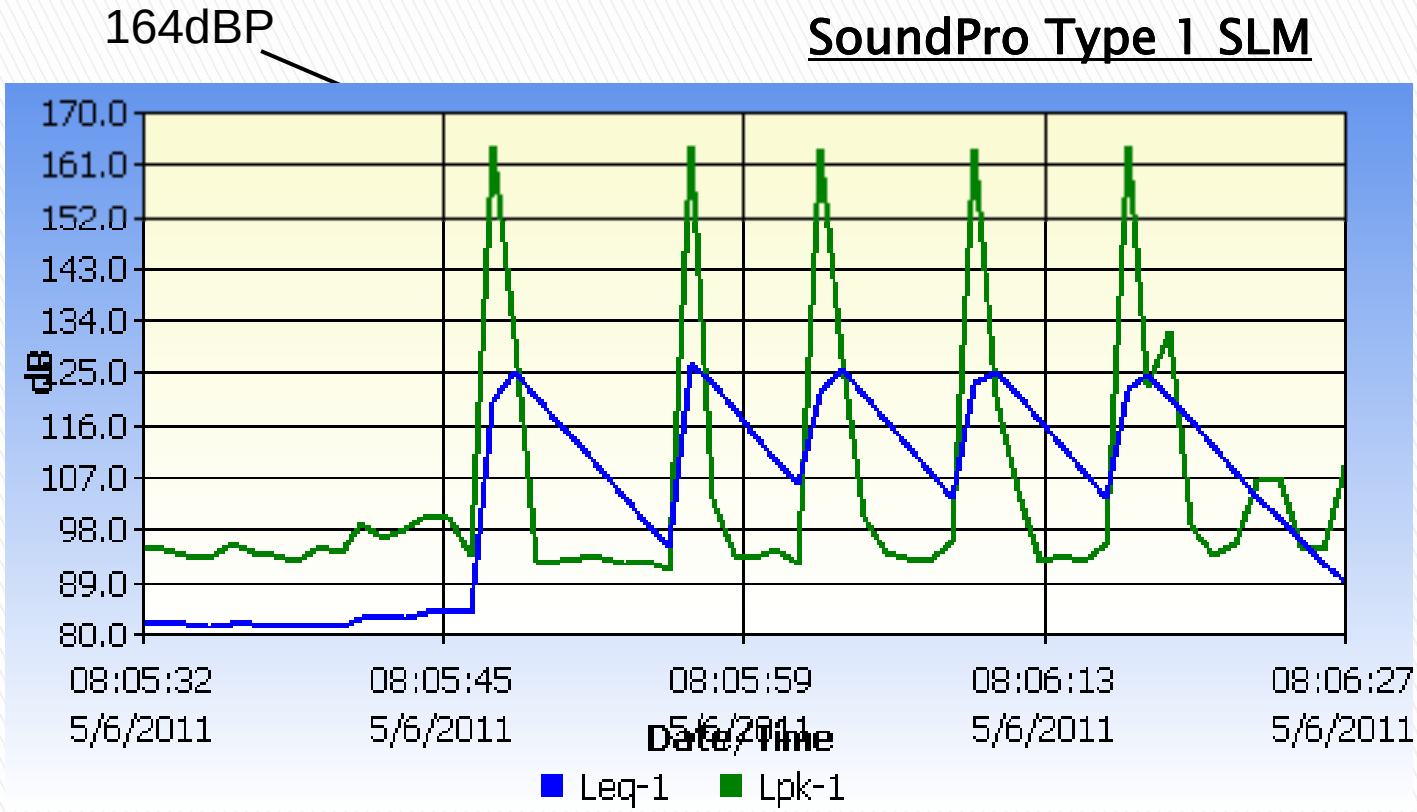
- 130–175 dB
- Duration of few usec
- Decay of 10 msec or more

Instrument		Maximum SPL	Peak Response Time
Personal Dosimeter		140 dBP	50 µsec
Type I SLM			
Quest Sound Pro	¼" mic	>165 dBP	12–18 µsec
Larson Davis LXT	¼" mic	>165 dBP	30 µsec
Larson Davis 824	¼" mic	>165 dBP	50 µsec



M16-A4 Rifle

Single Shot Peak Pressure Clipping



M16-A4 Rifle

Single Shot Peaks

Future Work

- Collect peak data
- Multiple shooters
- Sample in personal hearing zone
- Control booth noise attenuation
- Document noise reduction from the application of acoustical material

References

- Berger, E.H., L.H. Royster, and J.D. Royster. The Noise Manual. Fairfax: American Industrial Hygiene Association, 2003.
- Kardous, Chucri. "Limitations of Using Dosimeters in Impulse Noise Environments". Journal of Occupational and Environmental Hygiene July 2004: 456-462.
- Kardous, Chucri. "Noise Exposure Assessment and Abatement Strategies at an Indoor Firing Range". Applied Occupational and Environmental Hygiene 2003: 629-636.
- Murphy, William. "Assessment of Noise Exposure for Indoor and Outdoor Firing Ranges". Journal of Occupational and Environmental Hygiene September 2007: 688-697.

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Questions??