

GUN RANGE COMMUNITY NOISE

GOAL OUTDOOR RANGE SEMINAR 9/16/18

Erich Thalheimer, INCE Bd. Cert.



"Noise is in the ear of the beholder."

NOISE PRESENTATION OUTLINE

1. Thank you GOAL, nice job!
2. Who is this guy talking to us?
3. The Threat to Shooting Ranges
4. Introduction to Acoustics 101
5. Community Noise Regulations
6. How to Properly Measure Noise
7. Shooting Noise Prediction Models
8. Noise Control Mitigation Options
9. Questions and Discussion

ACOUSTICAL ENGINEER AND SHOOTER



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- *Acoustical Consulting Engineer*
- *INCE Board Certified*
- *Over 30 years experience*
- *Hundreds of projects nationwide*
- *National reputation within industry*
- *Big Dig, FHWA, NY City, Boston, etc.*
- *Authored dozens of technical papers**
- *Performed over 25 gun range studies*
- *Expert witness court testimony*
- *Competitive action shooter (USPSA/IPSC)*
- *Hunter, reloader, instructor, advocate*



THE NOISE THREAT IS REAL

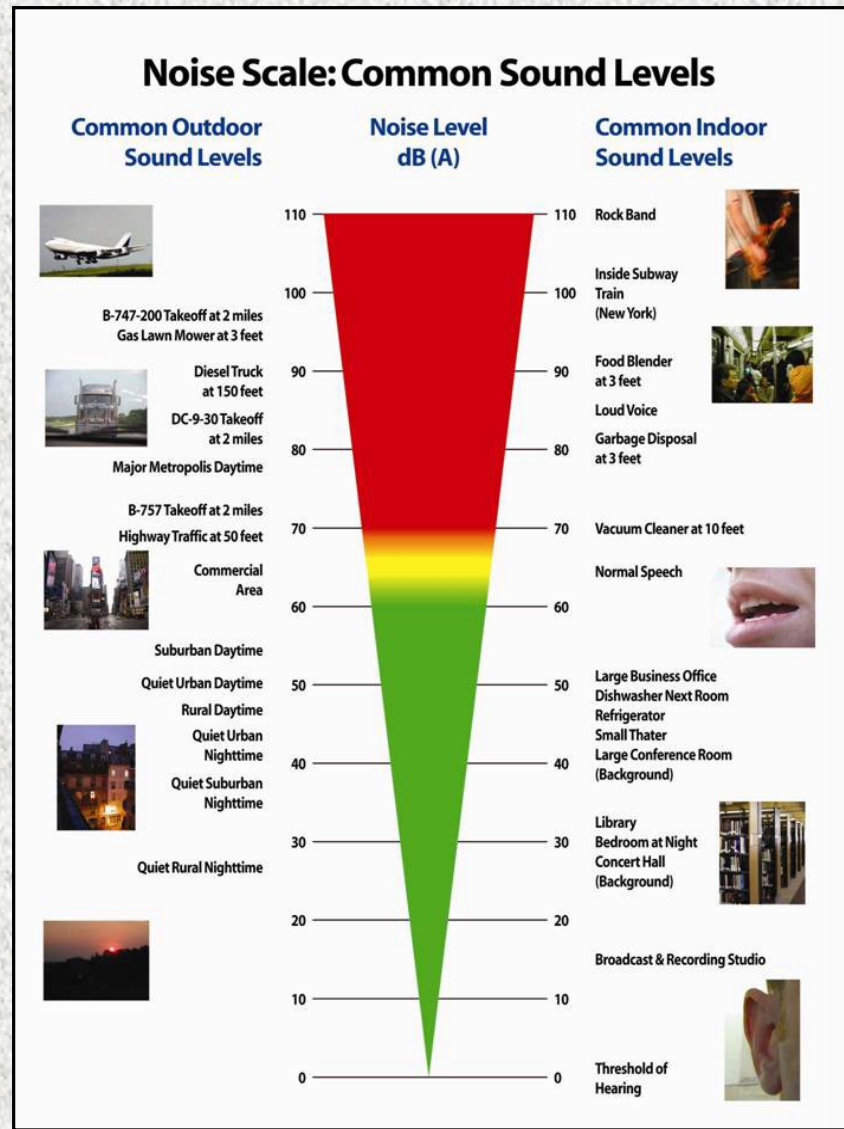
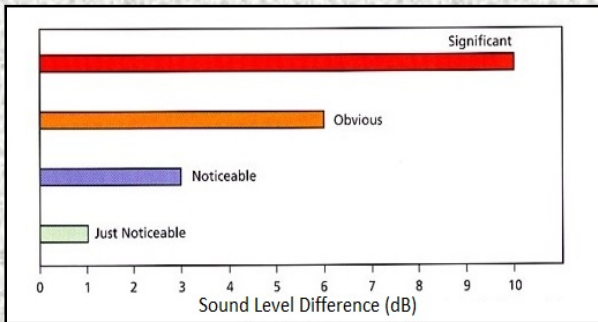
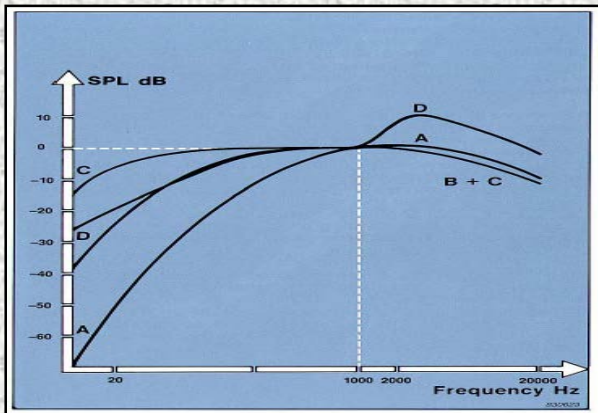
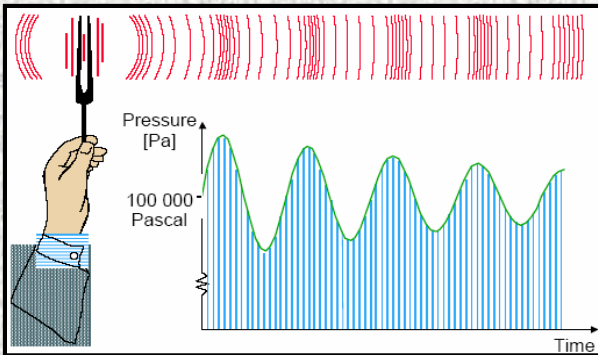
- **Noise complaints can shut down an active gun club**
- **Proposed new gun clubs can be denied permits**
- **Affluent neighbors with legal and political connections**
- **New neighborhoods encroaching closer and closer**
- **Legal actions under guise of reduced property values**
- **Easy information gathering and misuse against clubs**
- **Local boards not knowledgeable about acoustics**
- **Massachusetts media not known for being gun-friendly**

EXAMPLE AFFECTED CLUBS IN MA

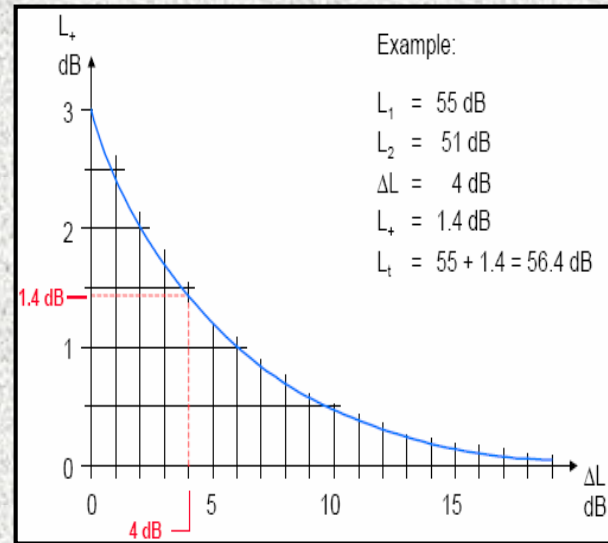
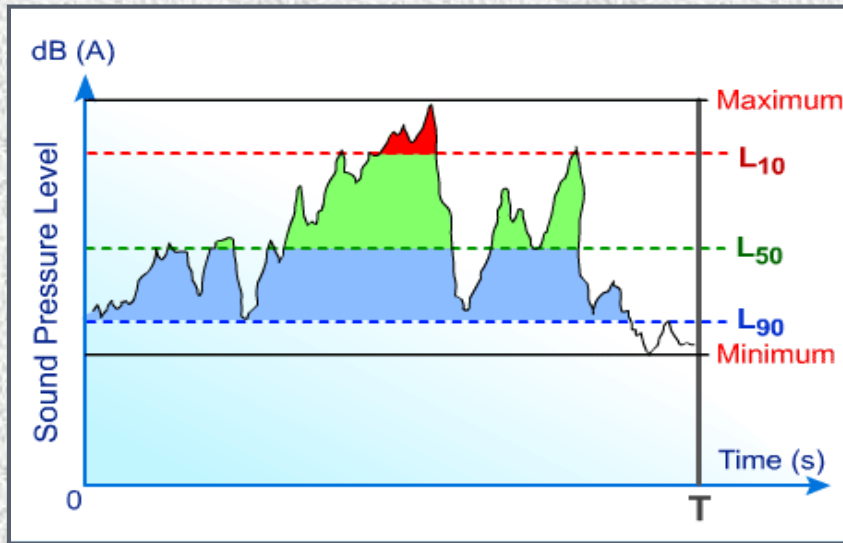
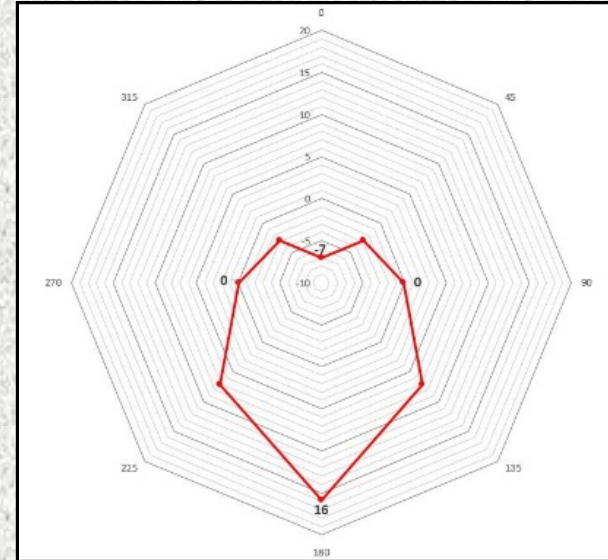
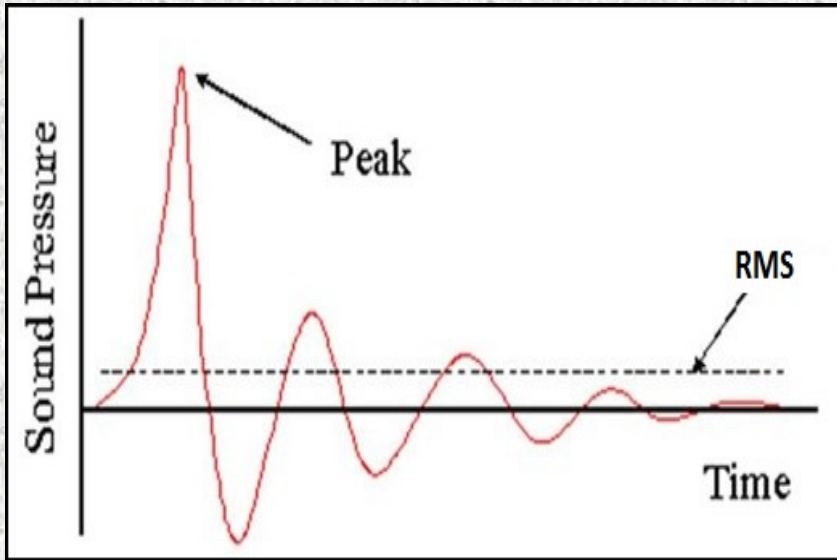
- Dudley Sportsmens Club, Dudley (*Shut down*)
- Westminster Rod & Gun Club, Westminster (*Shut down*)
- Midway Trap & Skeet, Falmouth (*Curtailed*)
- Hopkinton Sportsmens Club, Hopkinton (*Time restrictions*)
- Harvard Sportsmens Club, Harvard (*Time restrictions*)
- Westin Shooters Club, Weston (*Enhanced appeal*)
- Granby Bow and Gun Club, Granby (*Proactive avoidance*)
- Northampton Revolver Club, Northampton (*Complaints*)
- Wayland Rod & Gun Club, Wayland (*Neighbors complaining*)
- Mass Rifle Association, Woburn (*Expansion challenged*)
- Wayne's Weaponry, West Boylston (*Sale impeded*)
- **Nantucket Hunting Club, Nantucket (*Protracted legal battle*)**



BASIC ACOUSTICS 101



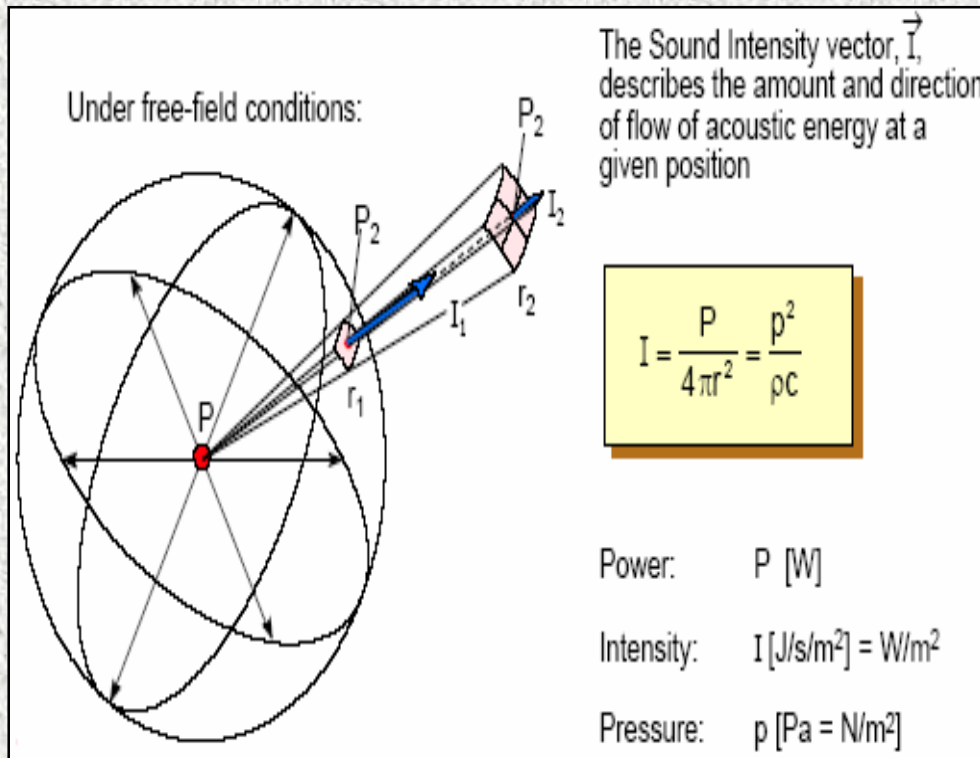
BASIC ACOUSTICS 201



In this case $1 + 1 \neq 2$



BASIC ACOUSTICS 301



L_w , Sound Power Level (PWL)

- Characteristic of the source
- Independent of environment

$$L_w = 10 \text{ Log } (W/W_o) \quad W_o = 1 \text{ pW}$$

L_I , Sound Intensity Level

- Power per unit area
- Vector quantity with magnitude and direction

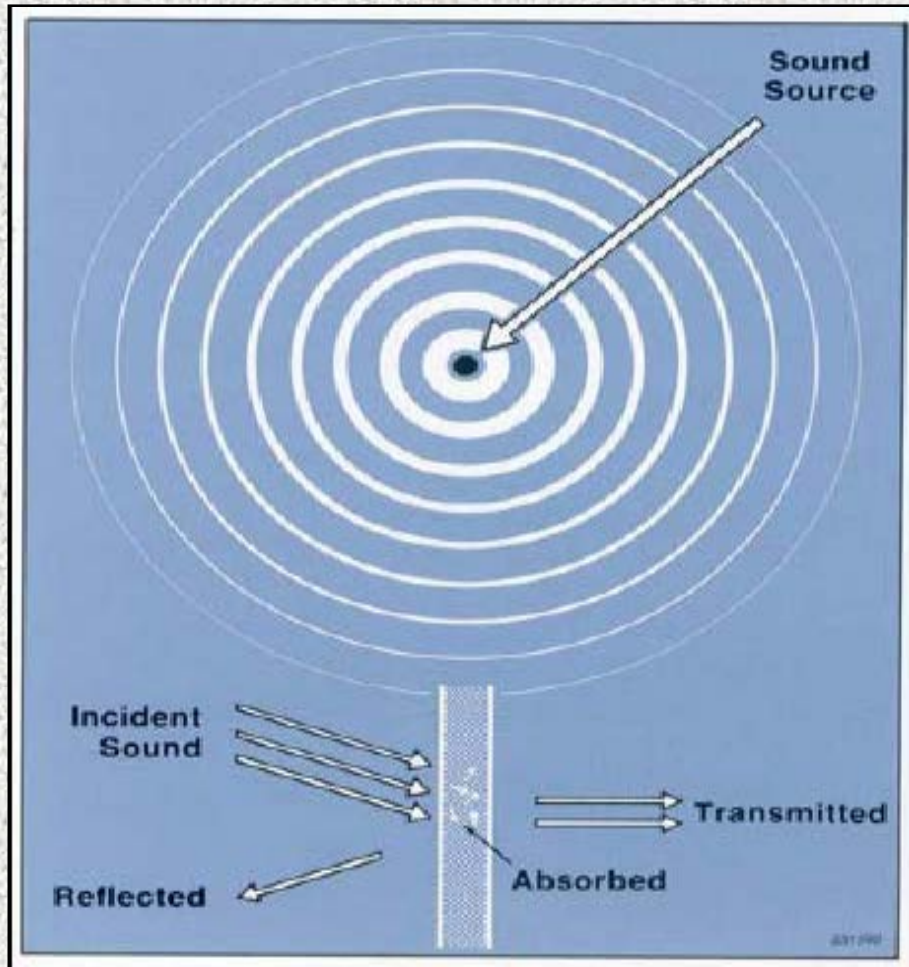
$$L_I = 10 \text{ Log } (I/I_o) \quad I_o = 1 \text{ pW/m}^2$$

L_p , Sound Pressure Level (SPL)

- What humans hear
- Dependent of environment

$$L_p = 10 \text{ Log } (P/P_o)^2 \quad P_o = 20 \mu\text{Pa}$$

BASIC ACOUSTICS 401



Acoustic Point Source in Free Field with Spherical Divergence:

Will attenuate by 6 dB/DD

Reflected + Absorbed + Transmitted = 1

Wavelength $\lambda = c / f$

If $c \approx 1130$ ft/s, then:

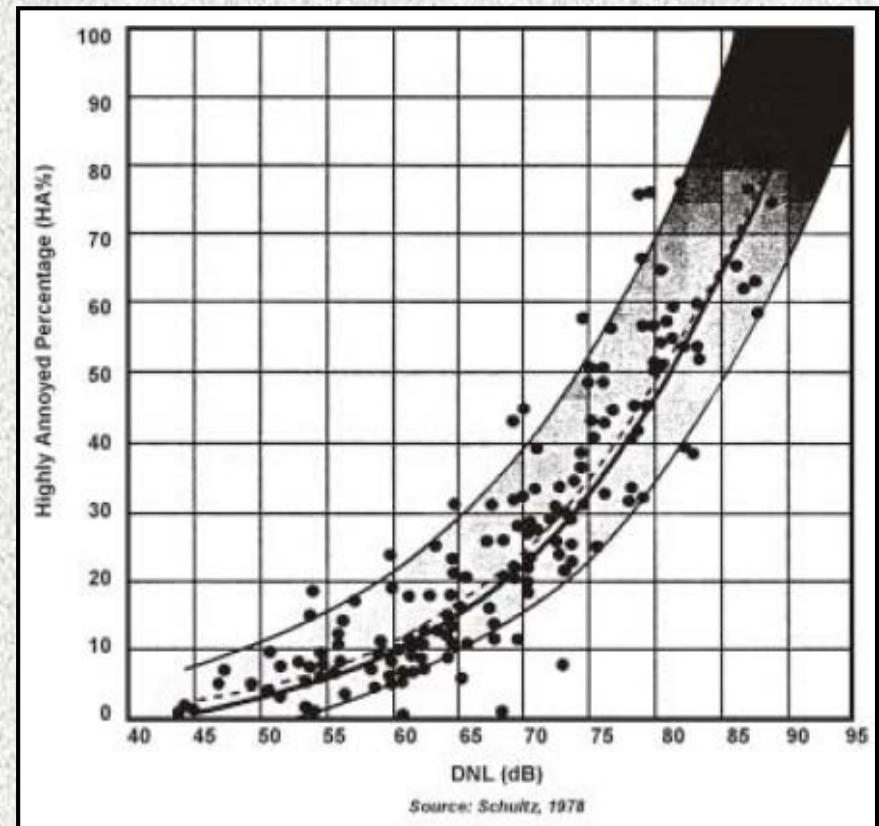
At 10kHz, $\lambda \approx 1$ inch

At 1kHz, $\lambda \approx 1$ foot

At 100Hz, $\lambda \approx 10$ feet

COMMUNITY NOISE REGULATIONS

Federal Regulations (CFR), State Laws and Regulations (CMR),
Local Noise Ordinances/Bylaws, Court Orders, Special Agreements



COMMUNITY NOISE REGULATIONS

310 CMR 7.10

Allows the Massachusetts State Department of Environmental Protection (MassDEP) to develop and enforce community noise regulations.

MassDEP Policy 90-001 (Form BWP AQ SFP-3)

Allows the Massachusetts State Department of Environmental Protection (MassDEP) to develop and enforce community noise regulations. Enforcement is usually done by the local Board of Health.

- Restricts noise to not exceed Quietest Background L90 + 10 dBA 'slow'
- Vaguely worded, lots of ambiguities, technically incomplete

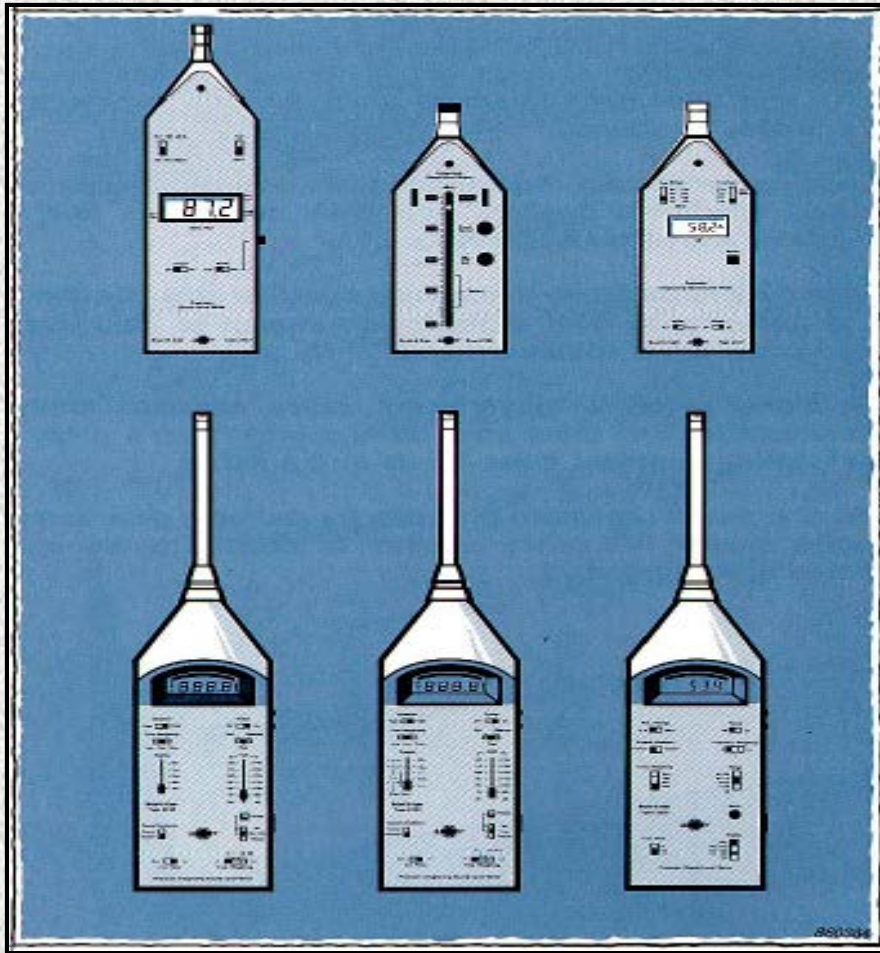
MGL Chapter 214, Section 7B

Massachusetts *"Shooting Ranges Noise Protection Law"* (2002)

- Exempts pre-existing gun clubs from noise restrictions 8 AM to 10 PM
- Club must still abide by local laws at the time the club was built



NOISE MEASUREMENTS



- Wide variety of noise instrumentation and manufacturers
- Simple SPL meters to spectrum analyzers
 - \$1,000 to \$25,000
- ANSI Standard S1.4
 - Type 0 Laboratory
 - Type 1 Precision
 - Type 2 General Purpose

(*) Smartphone Apps? – No, Negative, Nope, Non, Nein, Niet, Na, Ne, Nej, Nee, Nie, Neyn!

NOISE MEASUREMENTS

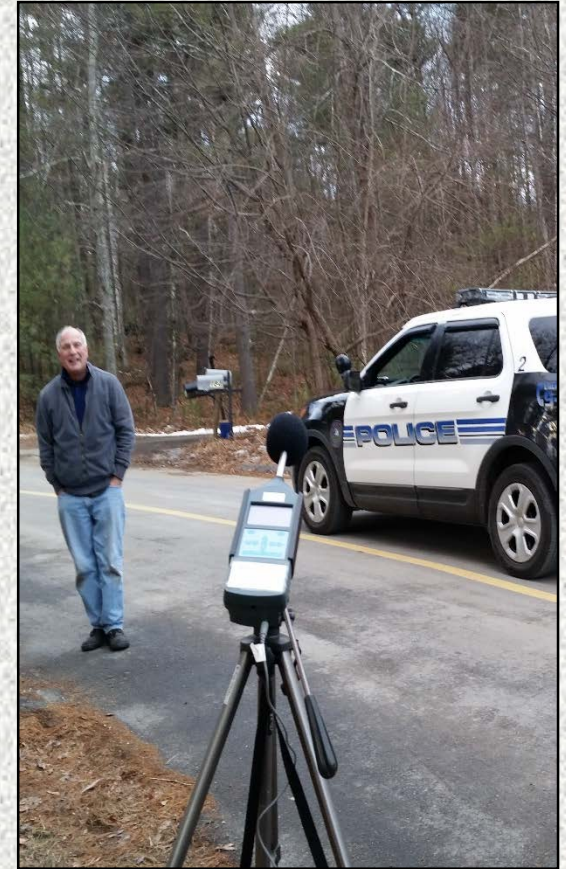


- ❑ **Defined in ANSI S1.4**
- ❑ **Dynamic Range:**
 - Noise Floor, Overloads
- ❑ **Frequency Weighting:**
 - dBA, dBC, dBZ
 - Octave Bands
- ❑ **Time Response:**
 - Slow, Fast, Impulse, Peak
 - 1 s, 125 ms, 35 ms, 20 μ s
- ❑ **Calibration:**
 - Field vs. Lab Certified

SHOOTING NOISE MEASUREMENTS

Must measure sound levels in accordance with applicable criteria or regulation!

The right dynamic range, frequency range, time response, noise metric, location.



FIREARMS & AMMUNITION

Shooting noise comes from (1) Firearm mechanics, (2) Propellant deflagration, (3) Supersonic air slap, and (4) Target impact



Handguns

17 HMR, 22 LR, 25 ACP, 380, 9mm, 38 Spl, 45 LC, 40 S&W, 45 ACP, 38 Super, 357 Sig, 357 Mag, 10mm, 44 Mag, 460/500 S&W



Rifles

22 LR, 45-70, 270, 30-30, 30-06, 223, 270, 300, 308, 7.62mm, 7mm Mag, 45-70, 338 Lapua, 300 BLK, 50 BMG



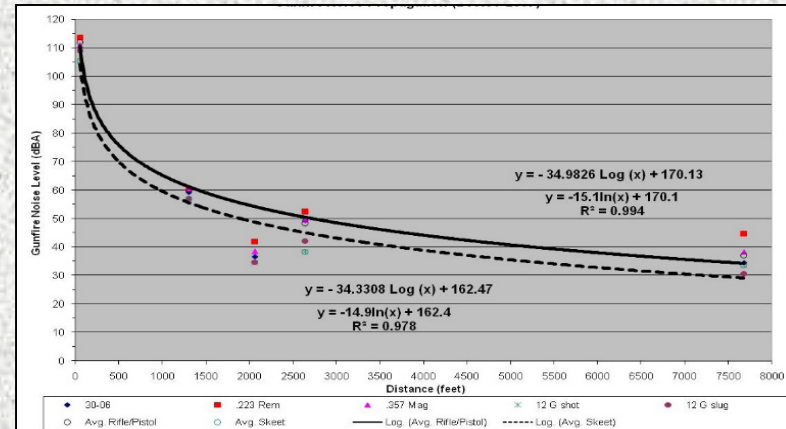
Shotguns

.410, 28 ga, 20 ga, 16 ga, 12 ga, 10 ga Shot and Slugs

NOISE PREDICTION MODELS

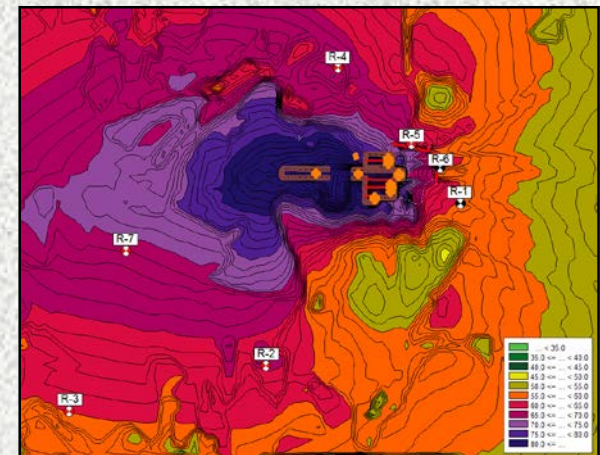
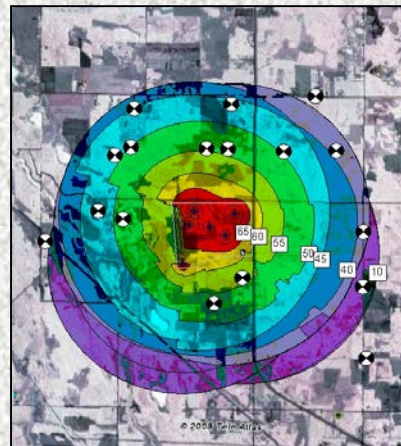
Empirical Noise Models From Measured Noise Data

- Proprietary models
- Typically generated in Excel
- To each their own results



Analytical General Purpose Commercial Noise Models

- Cadna-A by DataKustik
- SoundPLAN by SoundPLAN
- Predictor by Bruel & Kjaer
- SARNAM by US Army (*)

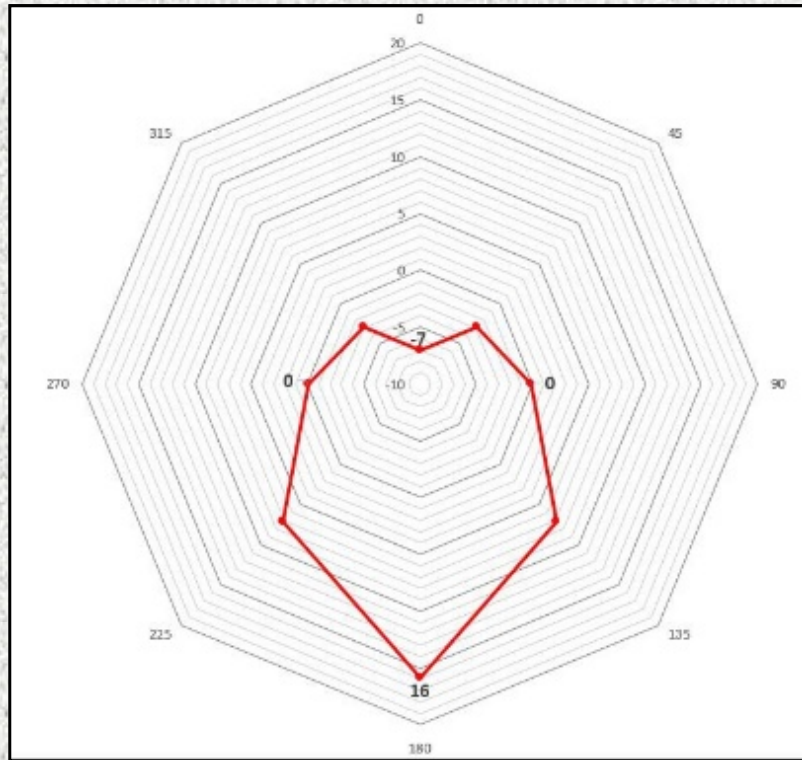


(*) Key – Must enter gun noise source data as sound power levels (PWL) with corresponding metrics to relevant community noise sound pressure level (SPL) criteria limits.

SHOOTING NOISE CONTROL OPTIONS

- **Source, Pathway, Receiver**
 - Time/Season Restrictions
 - Ammo/Gun Restrictions
 - Use of Suppressors
 - Reorienting Range Direction
 - Noise Barriers and Berms
 - Shooting Sheds/Enclosures
 - Residential Soundproofing
 - Monetary Settlements

NOISE MITIGATION EFFECTIVENESS



- **Reorienting Range Direction**
 - Take advantage of acoustical directivity
 - Waysides 16 dBA quieter than downrange
 - Rearwards 23 dBA quieter than downrange
 - Cost: Maybe free?

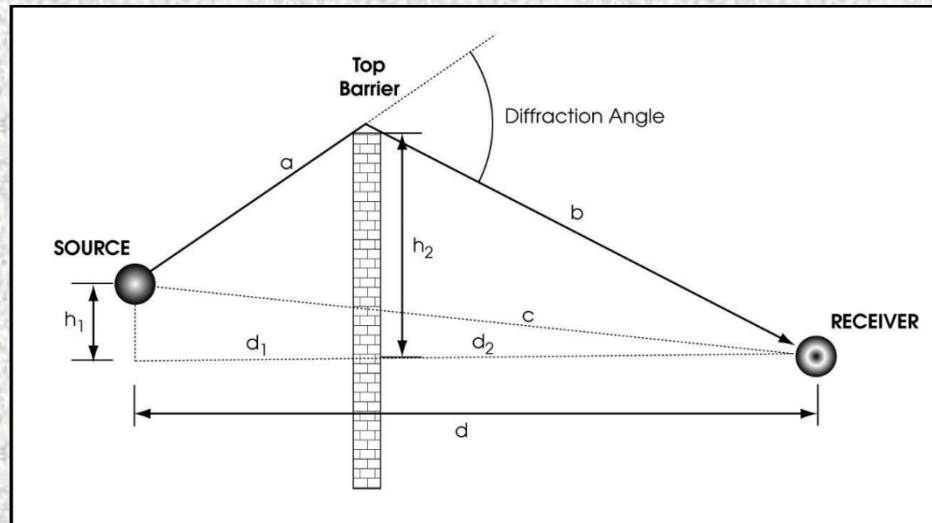
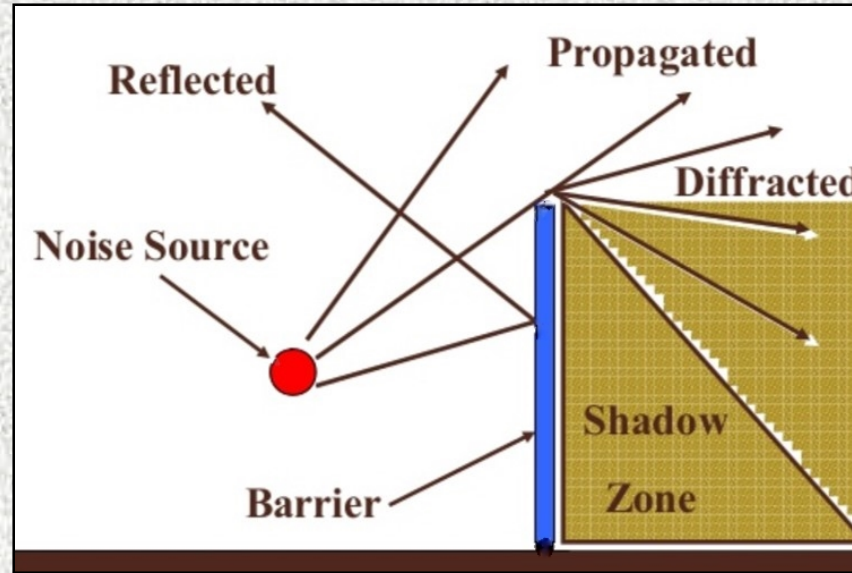
NOISE MITIGATION EFFECTIVENESS

• Noise Barriers & Earthen Berms

- Must block line-of-sight
- Must be long and tall
- No gaps or leaks
- Surface density >4 lbs/SF
- Wood, concrete, plastics
- Works best close to the source or receiver
- Barriers require anchoring
- Berms require 1:3 slopes
- Cost: \$15/SF to \$30/SF



NOISE MITIGATION EFFECTIVENESS



NOISE MITIGATION EFFECTIVENESS

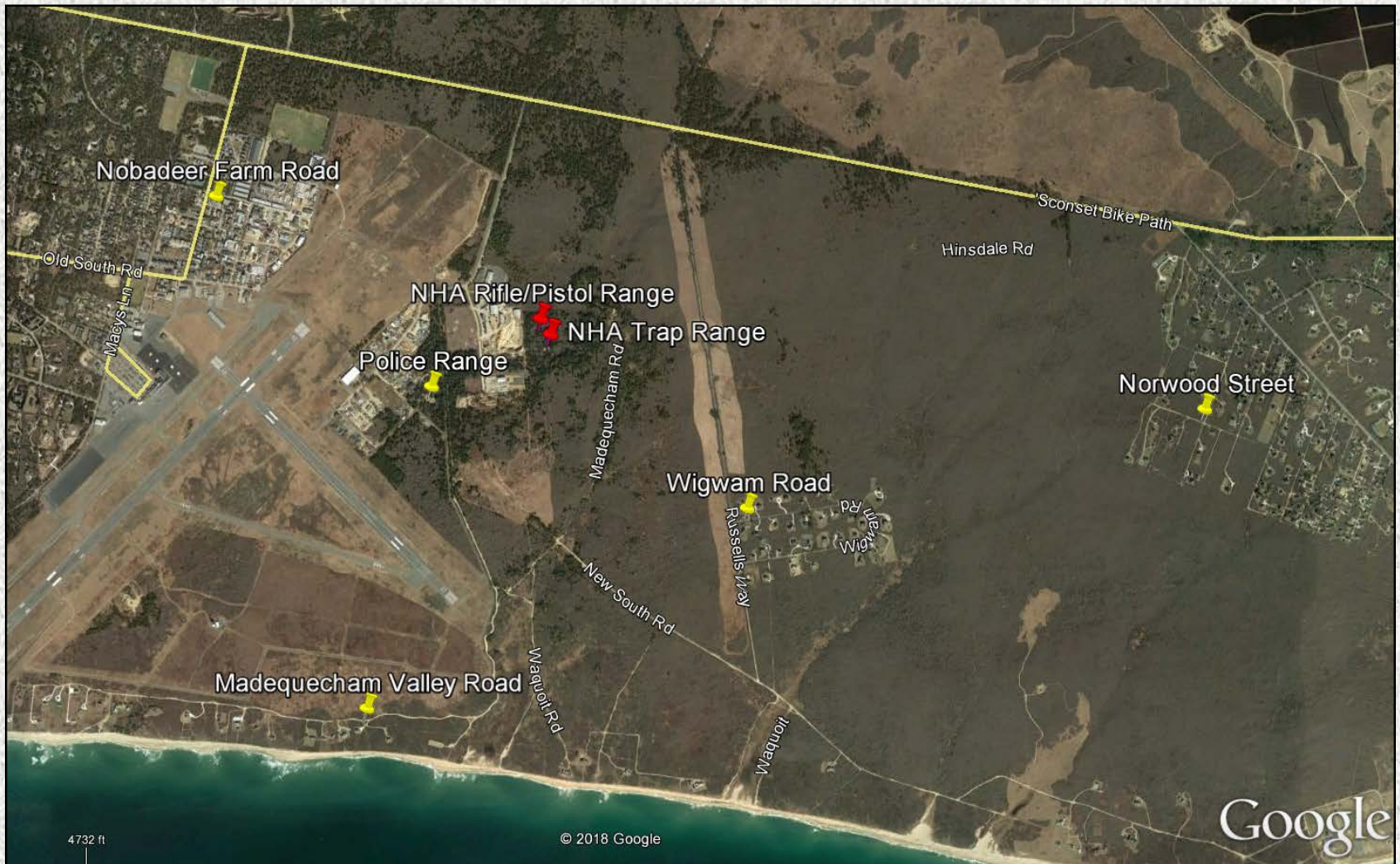


• Shooting Sheds & Enclosures

- Must block line-of-sight
- Open side facing away
- Surface density >4 lbs/SF
- Interior needs absorption
- Note ventilation/lighting
- Cost: \$1,000 to \$5,000



NANTUCKET HUNTING ASSOCIATION



NANTUCKET HUNTING ASSOCIATION



Nantucket Hunting Association v. Residents of Wigwam Road

- Desire to build a rifle/pistol/trap range
- NHA strong membership (some wealthy)
- Informal shooting done there for decades
- Private land, no public money involved
- Located adjacent to an active airport
- Near existing police training range
- Largely undeveloped conservation lands
- Nearest residence 3/4 mile away
- What could go wrong?

NANTUCKET HUNTING ASSOCIATION



Nantucket Hunting Association v. Residents of Wigwam Road

- First got involved in 2007
- Live-fire shooting noise tests in Nov. 2007
- 6 community receptors (including Wigwam)
- Planning Board and Zoning Board hearings
- Cadna-A noise model study in Feb. 2012
- Performed 2nd live-fire tests in Mar. 2016
- Critically reviewed opposition's reports
- Argued that Nantucket Noise Bylaw rules
- All in preparation for Land Court trial



NANTUCKET HUNTING ASSOCIATION

Cohen v. Rector, 2018 Mass. LCR LEXIS 5

Nantucket Hunting Association v. Residents of Wigwam Road

Cohen v. Rector, 2018 Mass. LCR LEXIS 5

Copy Citation

Massachusetts Land Court

January 8, 2018, Decided

MISCELLANEOUS CASE No. 13 MISC 476822 (GHP)

Reporter

2018 Mass. LCR LEXIS 5 *

MICHAEL COHEN; EDWARD M. SOFFEN as GENERAL PARTNER of THE SOFFEN FAMILY LIMITED PARTNERSHIP; ANDREW O. ESHELMAN; and DAVI-ELLEN CHABNER, TRUSTEE of the CHABNER REALTY TRUST, Plaintiffs, v. BARRY RECTOR, SYLVIA HOWARD, NATHANIEL LOWELL, JOHN MCLAUGHLIN, and LINDA WILLIAMS, As They Are Members of the NANTUCKET PLANNING BOARD; NANTUCKET HUNTING ASSOCIATION, INC.; and THE TOWN OF NANTUCKET, Defendants.

Core Terms

noise, Zoning, Bylaw, Shooting, special permit, measuring, Appeals, Plaintiffs', Planning, requires, nuisance, Lease, properties, parties, gunfire, frontage, feet, site plan, aggravement, street, commercial development, constructed, neighborhood, diminution, residents, Roadway, berms, recreation facility, provisions, firing

Judges: [*1] Gordon H. Piper ▼, Justice.

Opinion by: Gordon H. Piper ▼

Opinion

- Atty. Bill DeVasher & Atty. Eric Goldberg

WILCHINS | COSENTINO | FRIEND LLP

- Land Court trial Nov. 2017 (10 years!)
- Faced opposition lawyers and two acoustical expert witnesses
- Judge took months to decide
- **NHA prevailed!** Ruling dated 1/8/18
- MassDEP's noise regulation found to not be applicable in shooting range cases!
- Opposition has appealed, saga continues



ANY QUESTIONS?

