KINETICS Noise Control®

Factory Process & Equipment Noise

Engineering Controls

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- Over 32 years of experience in engineering, marketing, and sales of acoustic systems and products.
- Currently the North America Markets & Sales Manager for the Airflow Attenuation, Industrial, and Environmental markets, Kinetics Noise Control, Inc.
- Actively involved in AMCA, Air Movement Control Association and ASHRAE, American Society of Heating, Refrigeration, Air Conditioning Engineers

Factory Process & Equipment Noise – Engineered Controls
Purpose and Learning Objectives

- The purpose of this presentation is to discuss the effects of noise on human hearing, cost of hearing conservation programs and successful methods of noise control
- At the end of this presentation, you will be able to:
  1. Identify the 8-hour time weighted average noise level set by OSHA that requires the implementation of a hearing conservation program
  2. Identify the three main characteristics of effective noise control
  3. Describe the advantages of implementing engineering controls in lieu of personal protective equipment
  4. Identify different products used for controlling noise in a factory setting

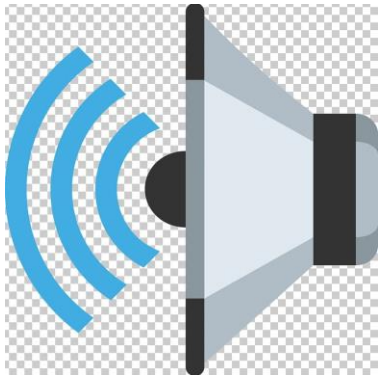
Which are you most likely to say?


"Wow, that is a nice *sound*!"


"Wow, that is a nice *noise*!"

Noise & Sound

- **Noise is unwanted sound**
- Sound is a propagating disturbance (a wave) in a fluid or solid
- In a solid (*structure-borne sound*), this disturbance travels as bending, compressional, torsional, or shear waves (*vibration*)
- In a fluid (*airborne sound*), this disturbance travels as a longitudinal compression wave (*this is what your ears sense, a fluctuation in sound pressure*)



When is Noise Control Required?

- OSHA's Noise Standard (29 CFR 1910.95) requires employers to have a hearing conservation program in place if workers are exposed to a time-weighted average (TWA) noise level of 85 decibels (dBA) or higher over an 8-hour work shift

Level (dBA)	Comment
65	normal conversation
90-95	hearing loss from sustained exposure
125	start to experience pain
140	quickly causes irreversible hearing damage

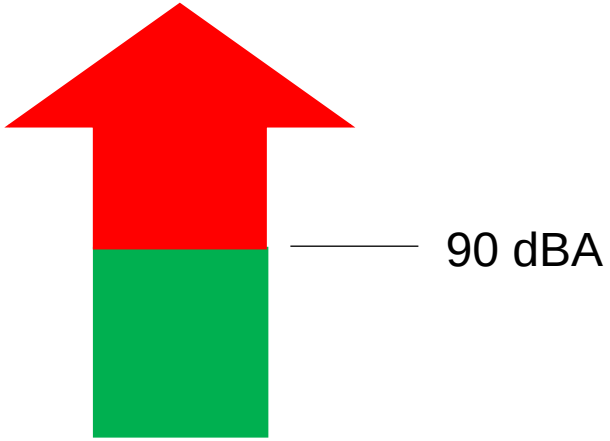
Overall Sound Level (dBA)

- Noise sources – levels for comparison

OSHA "Action Level" 8 hrs. Exposure	85 dBA, TWA
Common Sound	**Noise Level**
Pneumatic Chipper	115 dBA
Generators	105 dBA
Vacuum Pumps	105 dBA
Hammer Mills	102 dBA
Exhaust Fans	101 dBA
Air Compressors	99 dBA
Chop Saw	98 dBA
Metal Recycling	95 dBA
Forklift Traffic	87 dBA
Corn field, Middle of Nowhere at 4:00 am	25 dBA

Noisiest Manufacturing Industries

- Personnel exposed to noise levels above 90 dBA:
  - Lumber & Wood
  - Textiles
  - Petroleum & Coal
  - Utilities
  - Paper
  - Chemicals
  - Printing & Publishing
  - Fabricated Metals
  - Food
  - Furniture & Fixtures
  - Rubber & Plastics
  - Stone, Clay, & Glass
  - Apparel Manufacturing
  - Etc.



Rule of Thumb

- When you feel the need to raise your voice in order to be heard 3 feet away, the noise levels are probably 85 dBA or more and "action" is required

Types of Controls

- Engineering – eliminate or engineer out the noise by using noise control products or replacing loud, older equipment with new, quieter equipment

- Administrative – incorporate changes in work procedures such as reducing the duration & frequency personnel are exposed to high noise levels

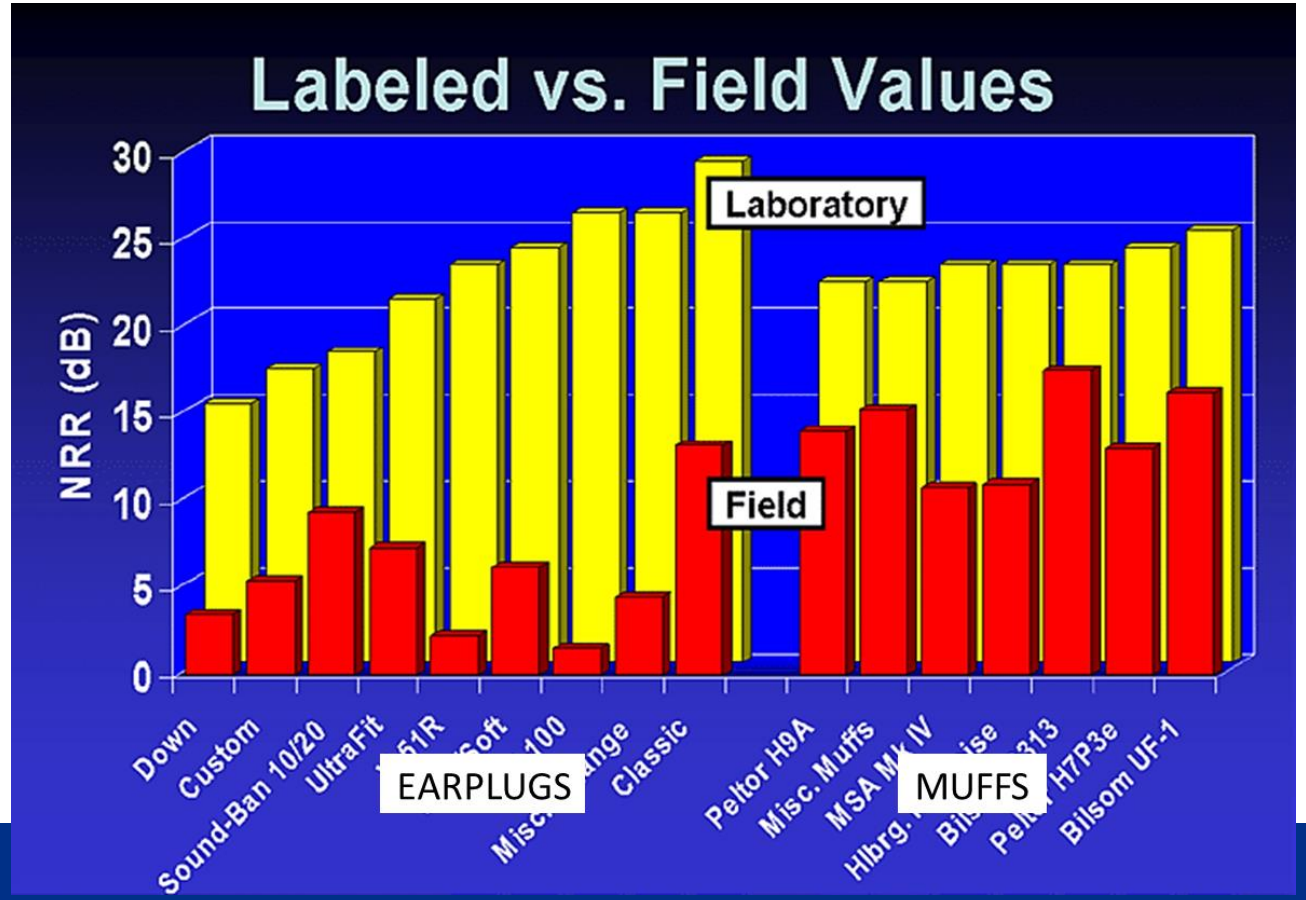
- PPE - personal protective equipment

Foam Ear Plugs - PPE

- Periodically removing ear plugs to use a radio or make a phone call exposes your ears to high noise and productivity suffers
- Some people find foam earplugs uncomfortable no matter standard or custom fit
  - Foam earplugs can wiggle loose, requiring work stops to refit them
- Do not have listen-through technology
  - They block important noises including traffic, alarms, warning shouts
- Ear health risk - bacteria love foam resulting in ear infections or tinnitus (constant ringing in the ears)

The True Story

- Earplugs and muffs – noise reduction rating (NRR)



Costs – Hearing Conservation Program

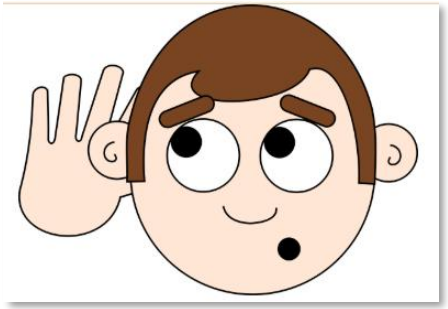
- Hearing conservation programs (HCPs) mandated by the US Occupational Safety and Health Administration (OSHA) can cost an employer about $350/worker/year as reported by OSHA

No. of Factory Employees	Total Estimated Cost *Per Year*
10	$3,500
30	$10,500
50	$17,500
100	$35,000
250	$87,500
500	$175,000

Dobie RA. Cost-Effective Hearing Conservation: Regulatory and Research Priorities. Ear Hear. 2018 Jul/Aug;39(4):621-630. doi: 10.1097/AUD.0000000000000523. PMID: 29251690.

#1 Noise Control Myth

- *Engineering controls are expensive*
- Compared to what?
  - Paying disability claims for noise induced hearing loss and Tinnitus?
  - Paying for the elements of an effective hearing conservation program?
  - Reduced safety risk?
  - Reduced situational awareness?

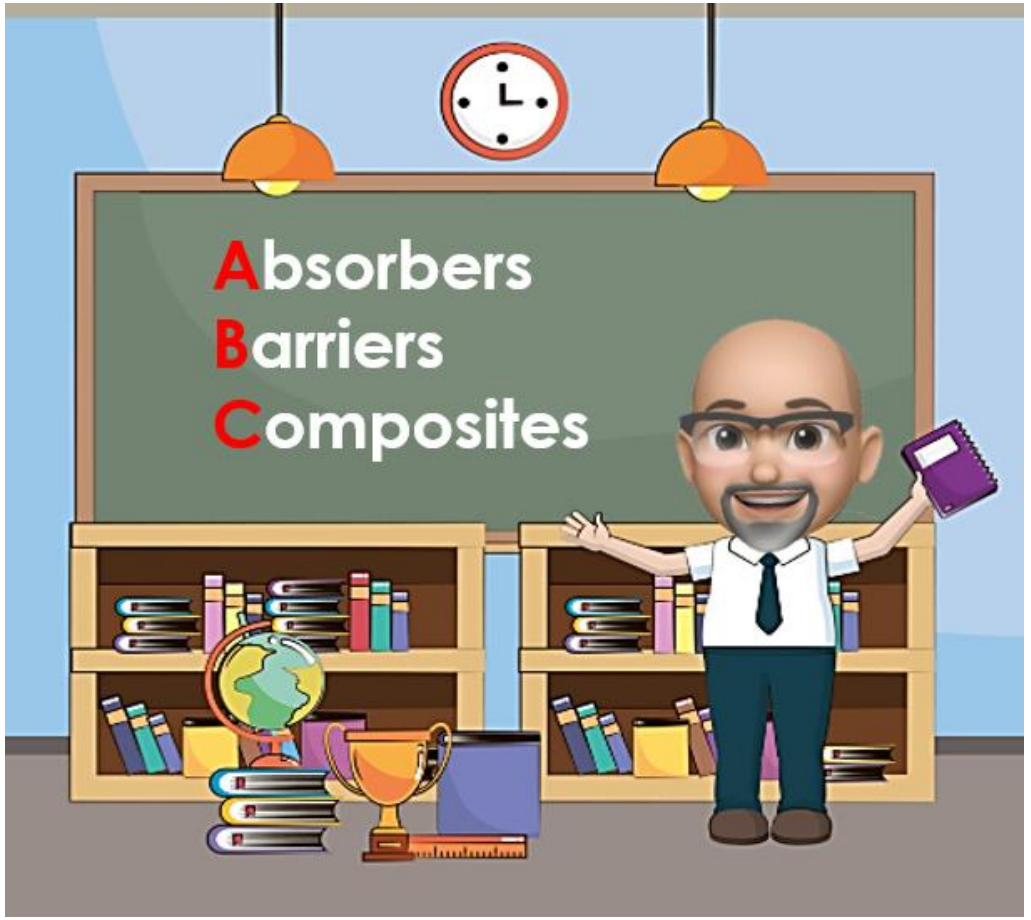


ROI – Using Engineering Controls

- Studies show a 10:1 ROI on dollars spent on engineering controls compared to paying disability claims
- Many engineering control projects exhibit an ROI of 2-4 years versus hearing conservation costs which continue year over year, over year, over year…

A Roadmap for Future Noise Control in Acquisition: Acoustical Engineering Controls and Estimated Return on Investment for DOD Selected High Noise Sources, Raymond Fischer, Noise Control Engineering, Inc., Kurt Yankaskas, Office of Naval Research, Code 34, 31st International System Safety Conference, Aug. 11-16, 2013, Boston MA

Learning the ABC's of Acoustics

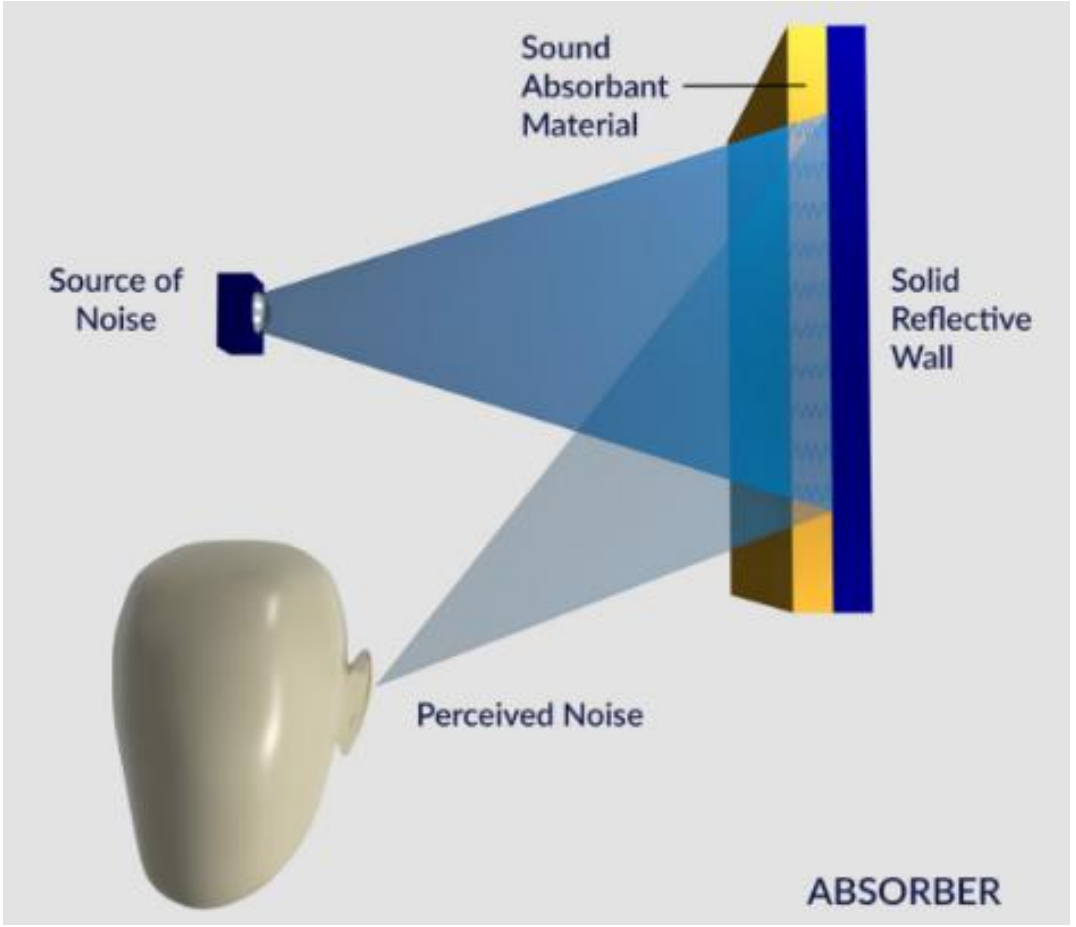


Sound Absorption

- If it is not possible to reduce noise at its source or block its path, then sound absorption in the space should be considered
- Noise reduction targets of 10 dBA or less are suitably obtained using sound absorption techniques (10 dBA reduction is perceived as sounding half as loud and significant)
- Walls and ceiling of the space become the focus
- Key factors:
  - Construction of walls, ceiling, and floor
  - Length, width, and height of the space
  - Lighting, sprinklers, and other obstructions

Sound Absorption

- A material takes in sound energy as opposed to reflecting the energy
- Part of the absorbed energy is transformed into heat and part is transmitted through the absorbing body



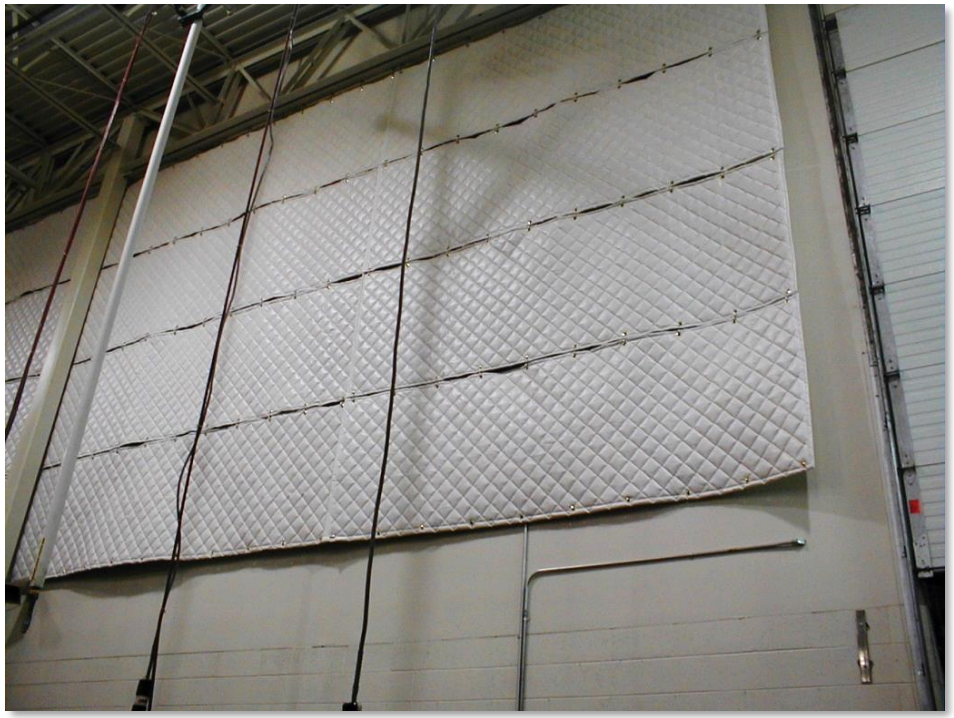
Quilted Absorber

- Issue – reverberant (echo) industrial facilities:
  - Automotive garages
  - Environmental control booths
  - Material handling wrap
  - Machine housing

- The **thicker** the material the **better** the sound absorption

Quilted Absorber

- *High bay area – very congested processes*



Hanging Baffle

- Reverberant (echo) industrial facilities:
  - Warehouses
  - Conveyor facilities
  - Mail handling facilities
  - Printing facilities

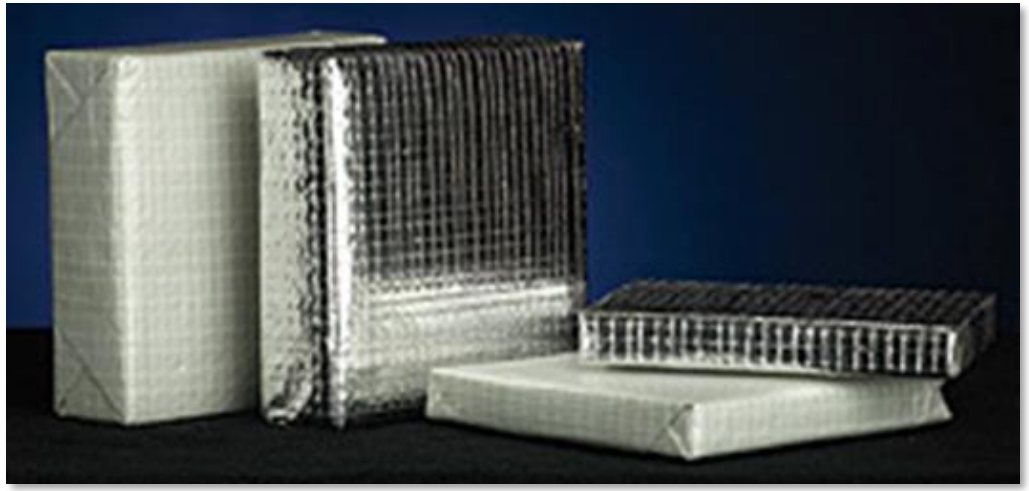
- Various facing materials standard and FDA approved

Hanging Baffles

- *Candy factory, congested process, FDA approved facing required*

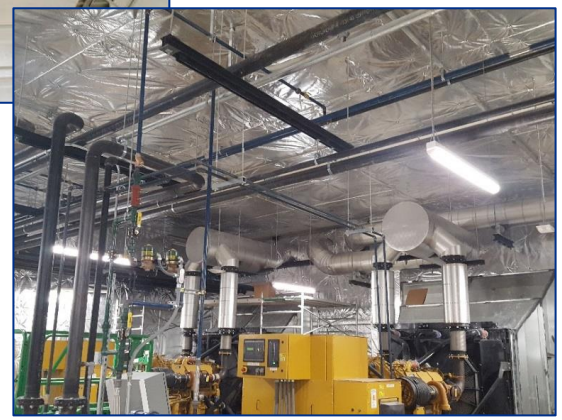
Sound Absorption Panel

- Reverberant (echo) industrial facilities:
  - Warehouses
  - Conveyor facilities
  - Mail handling facilities
  - Printing facilities



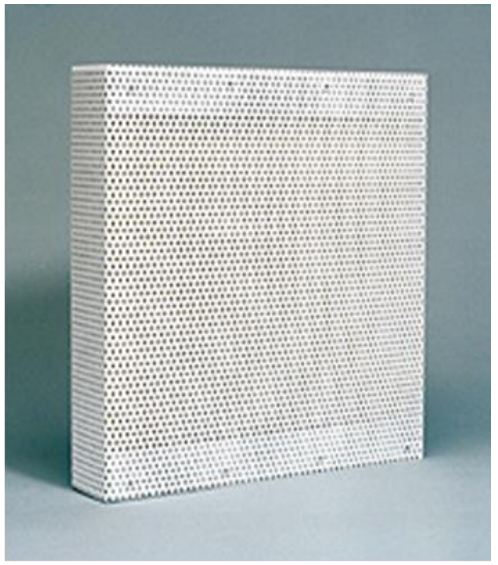
Sound Absorption Panel

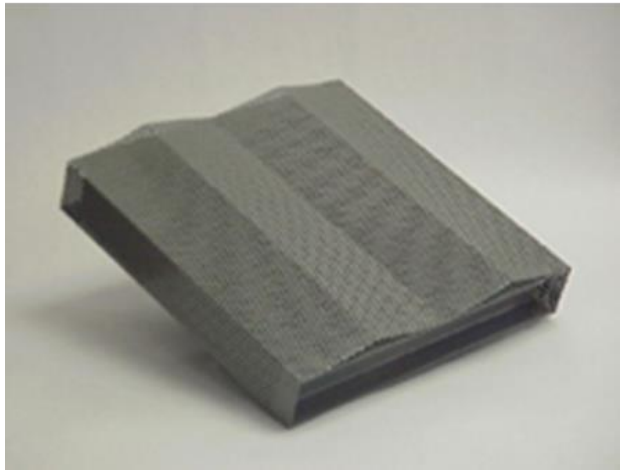
- *Shipping and receiving – forklift traffic & pump room*



Rigid Panel Absorber

- Reverberant (echo) industrial facilities:
  - Wastewater Treatment Plants
  - Indoor or outdoor equipment yards
  - Shipping containers used for generator enclosures
  - Anywhere where high durability is required





Rigid Panel Absorber

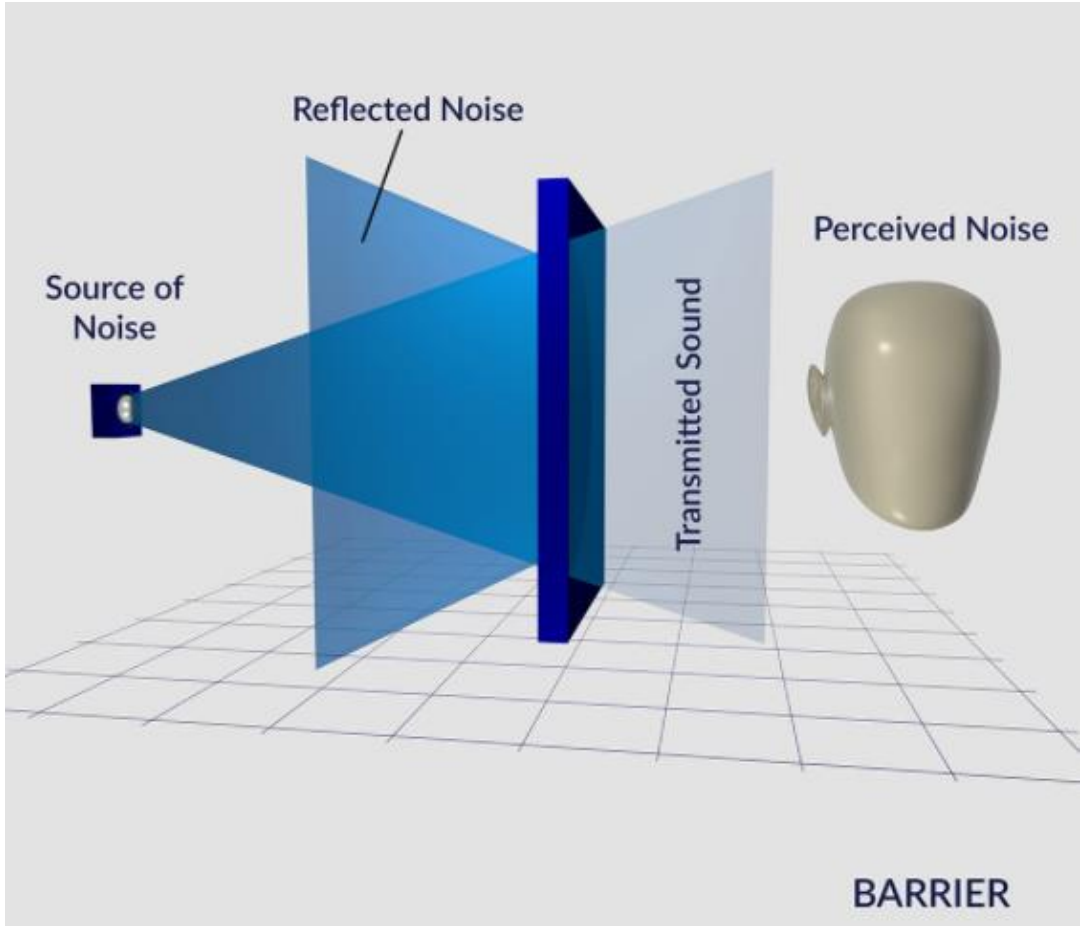
- *Process manufacturing & test cell applications*

Sound Blocking

- Significant amount of noise can be reduced by blocking the path of the noise source
- Noise reduction targets range from 18 dBA – 45 dBA
- Treating noise at the source becomes the focus
- Key factors:
  - Proper ventilation of heat radiating equipment
  - Access for routine and catastrophic maintenance
  - Visual access (i.e., ports, process, personnel, etc.)

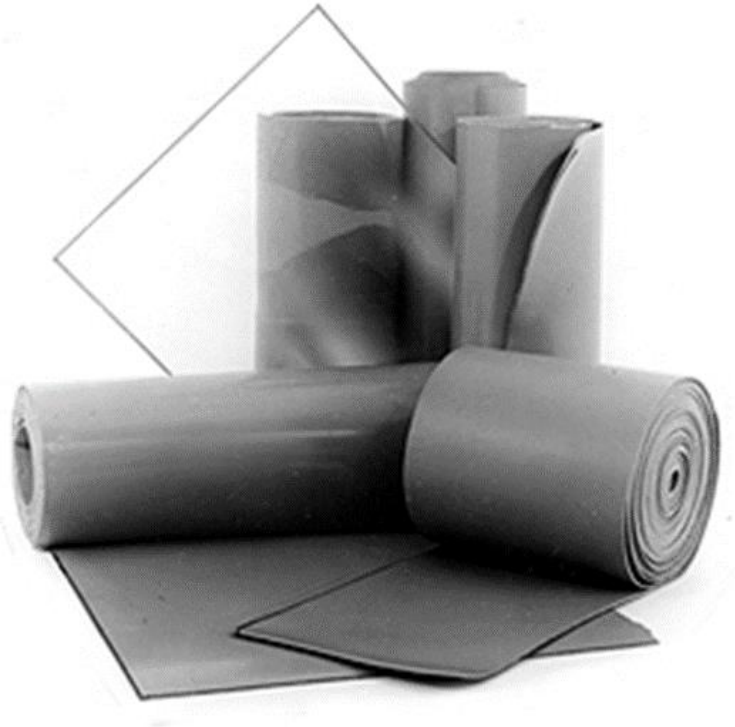
Sound Blocking

- Some sound energy is reflected while some is blocked
- The magnitude of sound energy blocked is in direct relation to the mass of the material (lb./ft2)



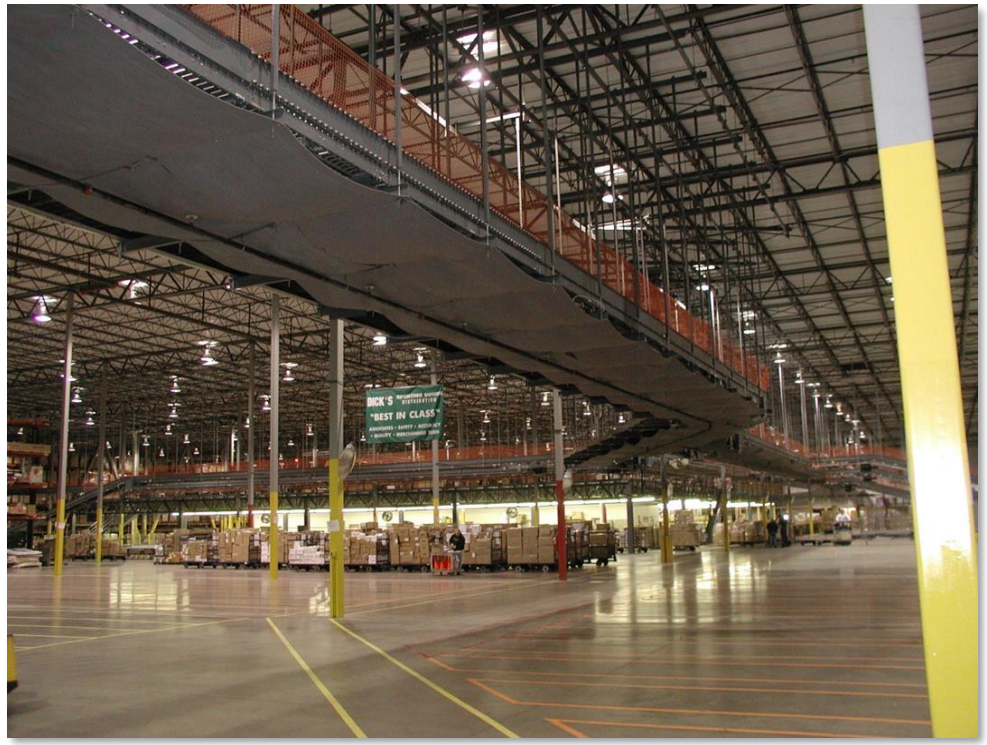
Flexible Barrier

- Above drop ceilings of break rooms, facility manager's office
- Part chutes
- Material handling duct
- Process piping



Flexible Barrier

- *Under conveyor – distribution warehouse*

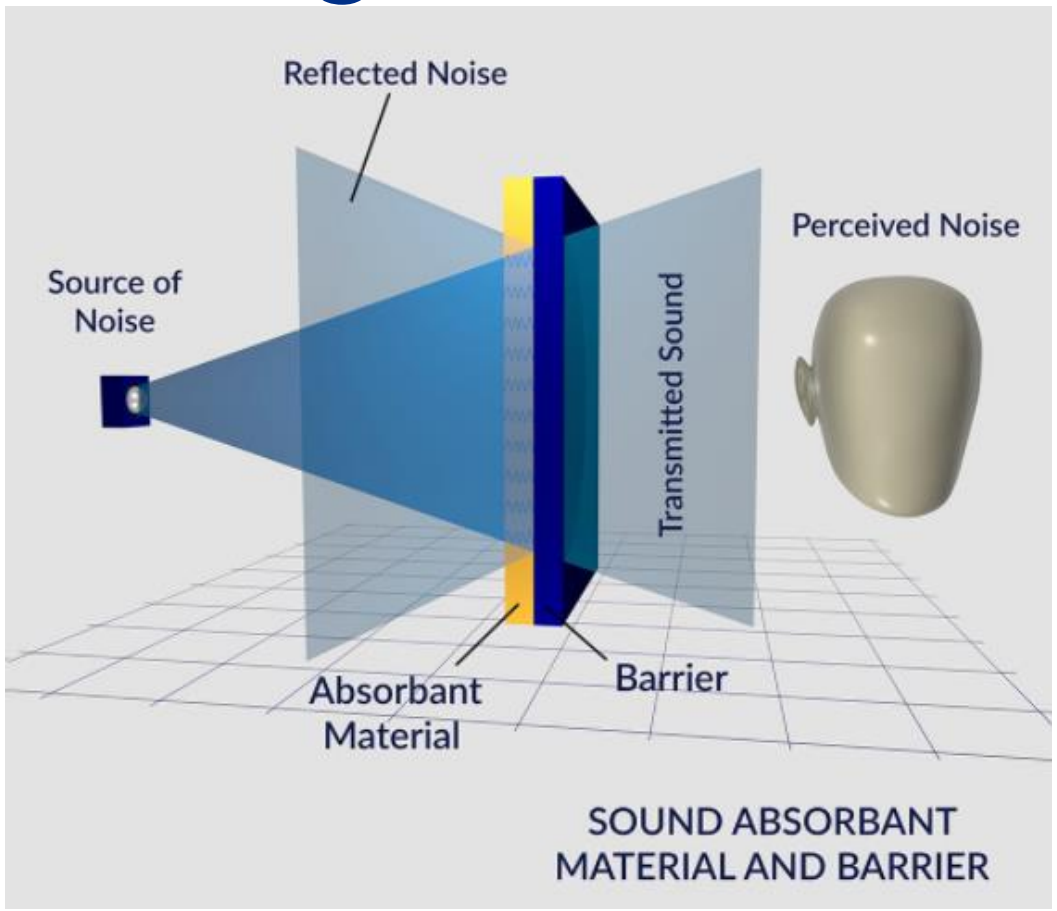


Sound Absorption & Blocking

- Often referred to as a sound absorption and blocking composite
- Significant amount of noise can be reduced by combining sound absorption and sound blocking
- Noise reduction targets range from 18 dBA – 45 dBA
- Treating noise at the source becomes the focus
- Key factors:
  - Proper ventilation of heat radiating equipment
  - Access for routine and catastrophic maintenance
  - Visual access (i.e., ports, process, personnel, etc.)

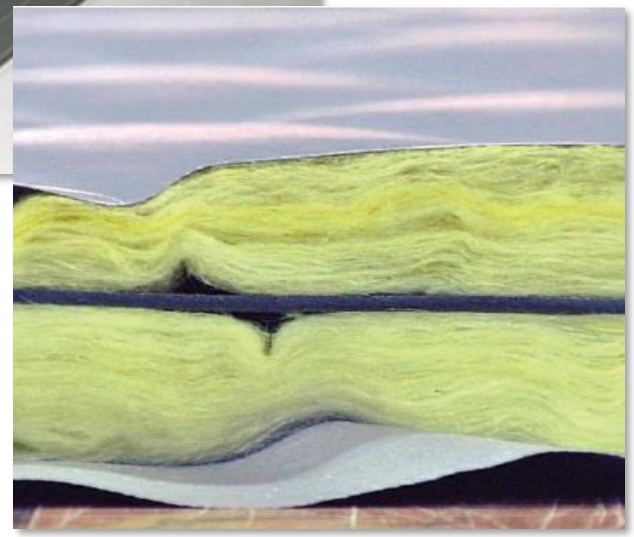
Sound Absorption & Blocking

- Sound absorbing material takes in sound energy as opposed to reflecting it
- Part of the absorbed energy is transformed into heat and part is transmitted through the absorbing body
- A portion of the remaining sound energy is blocked by the solid mass material



Quilted Barrier Composite

- Both absorbs and blocks sound
  - Fiberglass media
  - Aluminum, vinyl impregnated, fiberglass facing
  - 1.0 psf. / 2.0 psf. mass-loaded vinyl



Quilted Barrier Composite

- *Custom system – crosscut saw, aluminum extrusions*
- Engineering controls can be simplistic
- High frequency intense whining noise
- Only the operator requires PPE

Quilted Barrier Composite

- *Custom system – cutting process*

Quilted Barrier Composite

- *Custom system – aluminum de-bridging process*
- Custom designed to fit the process
- High frequency intense whining noise
- 100 dBA reduced to 85 dBA

Quilted Barrier Composite

- *Custom system – radiator fin press application*

Quilted Barrier Composite

- *Custom system – wire braiding process*
- 15 dBA reduction in mid frequency range
- Easy access, process viewing
- No interference with overhead sprinklers

Quilted Barrier Composite

- *Sliding doorway & strip curtains*
- Incorporates clear-view ports at proper elevation
- Used to retrofit separation between high noise process area and shipping & receiving area

Quilted Barrier Composite

- *Retrofit mechanical room – compressors & fan*
- Retrofit mechanical room corner of facility
- Controls radiated noise from process centrifugal fan and compressors
- Easy installation

Quilted Barrier Composite

- *Manufacturing process – plywood tongue & groove*

Quilted Barrier Composite

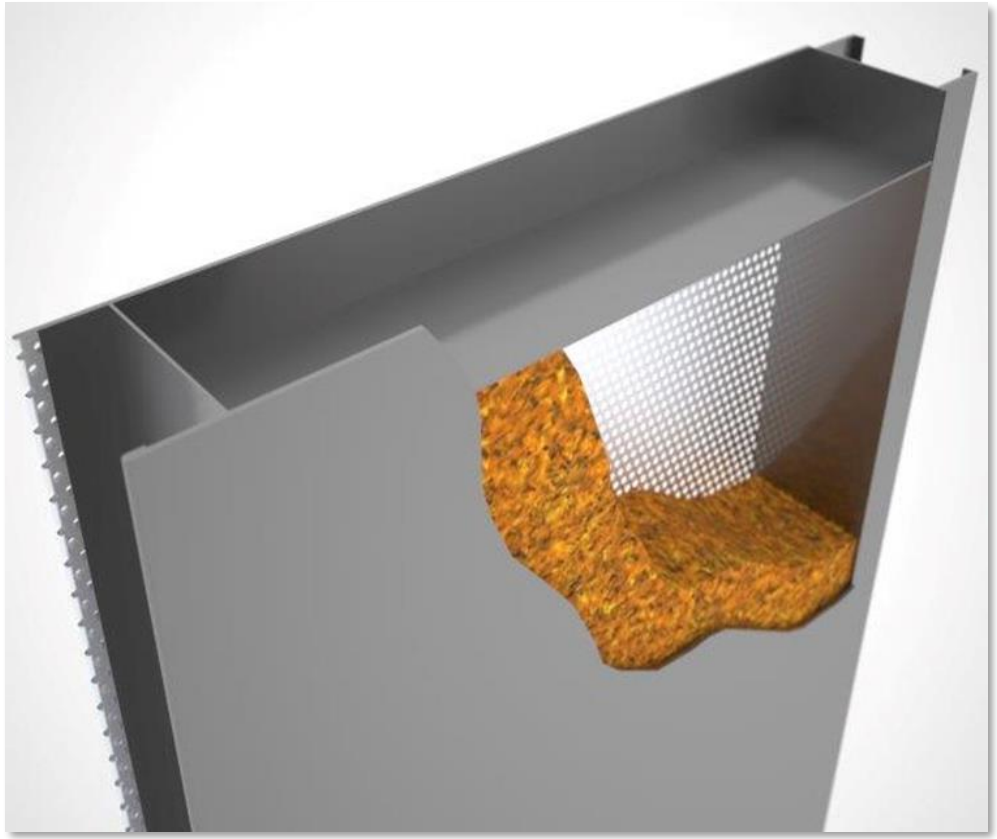
Manufacturing process – office space

Quilted Barrier Composite

- *Portable screens*
- Can be used in multiple locations for intermittent equipment and process operations

Rigid Double-Wall Composite

- Both absorbs and blocks sound
  - Fiberglass / mineral wool media
  - Galvanized, stainless steel, aluminum sheet construction
  - Available in various thicknesses for increased noise reduction performance



Rigid Double-Wall Composite

- *Custom system – stamping press*

Rigid Double-Wall Composite

- *Custom system – CNC machining process*

Rigid Double-Wall Composite

Test cell – media filter manufacturing

Rigid Double-Wall Composite

- *Custom system – highly accessible, mezzanine elevated process*

Rigid Double-Wall Composite

- *Process fan enclosure – petrochemical facility*

Rigid Double-Wall Composite

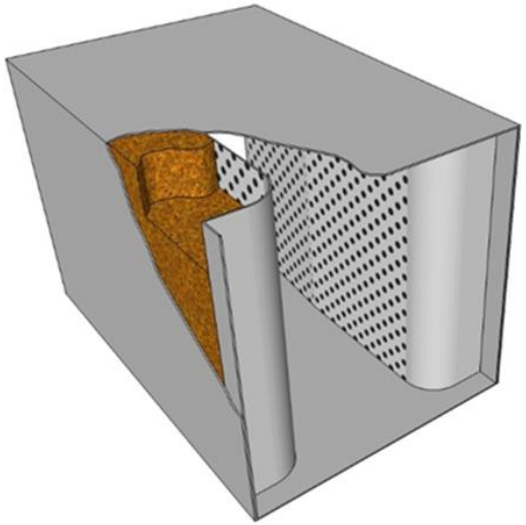
- *Test cells – automotive manufacturing*

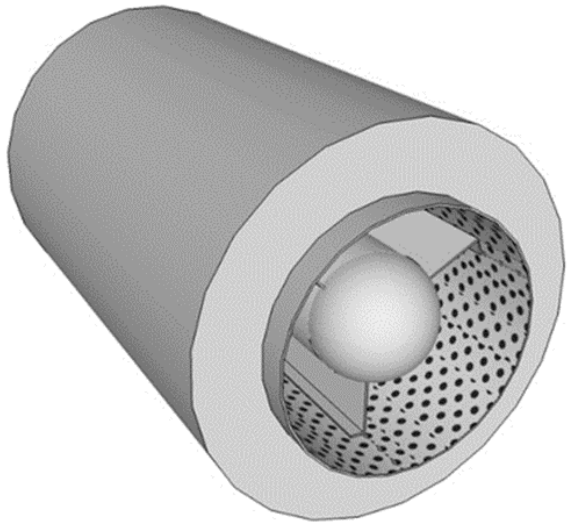
Ventilation Silencing

- Fans used to move processes (i.e. dust collection, particulate conveying) or cool equipment and personnel all make noise
- Noise is generated by the fan blades imparting upon air molecules or bad flow conditions
- Quieter fan models and type can be considered as a possible solution
- Silencers & acoustic louvers can be tuned to balance pressure loss and noise reduction are a great method of solving noise issues
- Key factors:
  - Airflow rate (cfm)
  - Available fan/system static pressure (energy)

Ventilation Silencing – Types

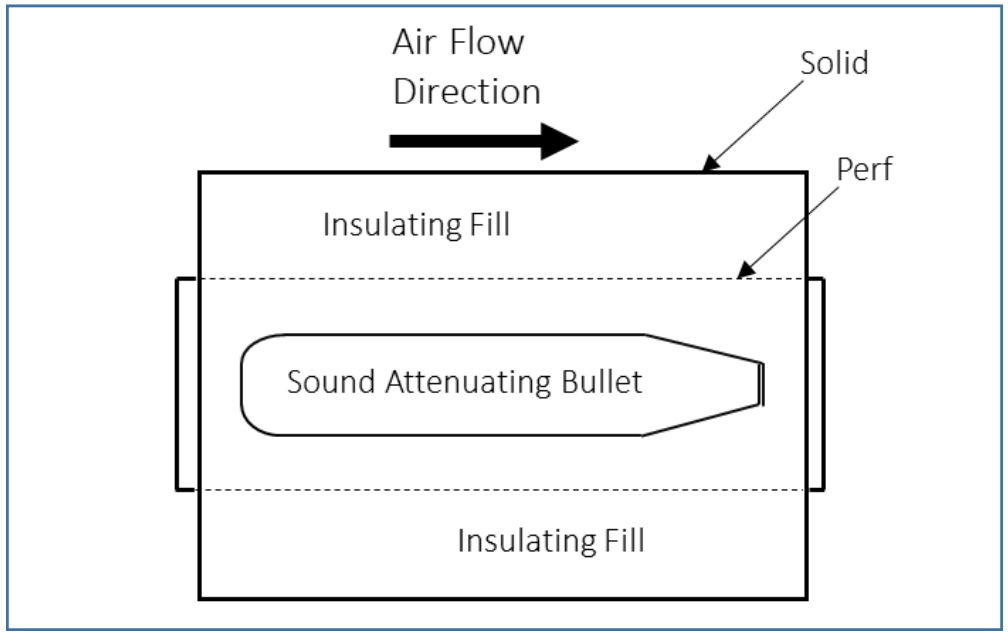
- Silencers come in many shapes, sizes, and performance
- Fixed-blade acoustic louvers, many models, many thicknesses

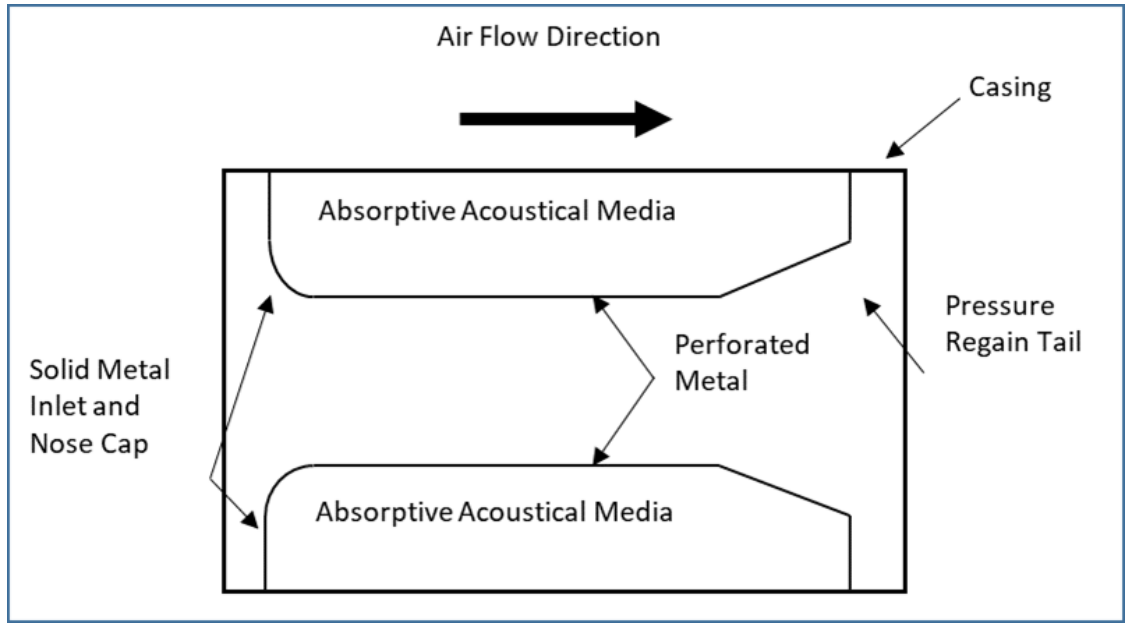




Ventilation Silencers

What makes it tick?





Ventilation Silencer

- *General building exhaust*

Ventilation Silencer

- *Industrial process centrifugal fan intake & discharge*

Ventilation Silencer

- *Process fan exhaust*

Ventilation Silencer

- *Dust collection process fan exhaust*

Fixed Blade Acoustic Louver

- *Pump house – general ventilation*

KINETICS Noise Control®

Questions?

We Create Quiet that
Improves the Quality of Life

John Sofra

Markets & Sales Manager – Commercial
Airflow, Industrial, Environmental

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