



Treat yourself to better rental service.

Thank You for Attending Today's Webinar:

Basics & Benefits of Sound and Noise



Your Host

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Operations Manager
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Featured Speaker

Andy Bragg
Director of Sales
SKC Inc

Noise Measurement and Basics of Hearing Conservation

Andy Bragg – COHC
Director of Sales
SKC Inc.



Agenda

- Why Do We Care?
- Basic Sound Explanation (Noise?)
- Regulations (Key Terms)
- Basic Instrument Explanation
 - Noise Dosimeter
 - Sound Level meter
- NoiseChek training
- Questions

Objectives

- Introduction to hearing conservation
- OSHA regulations (and others) as it pertains to noise measurement
- Explain sound pressure level, frequency, and respective units of measure
- Six key terms for Dosimetry Studies (if you know these, it's half the battle):
 - Describe level average, time weighted average, and dose
 - Explanation of criterion, threshold, and exchange rate
- Make Sure that you are comfortable using a dosimeter to conduct a Noise Survey

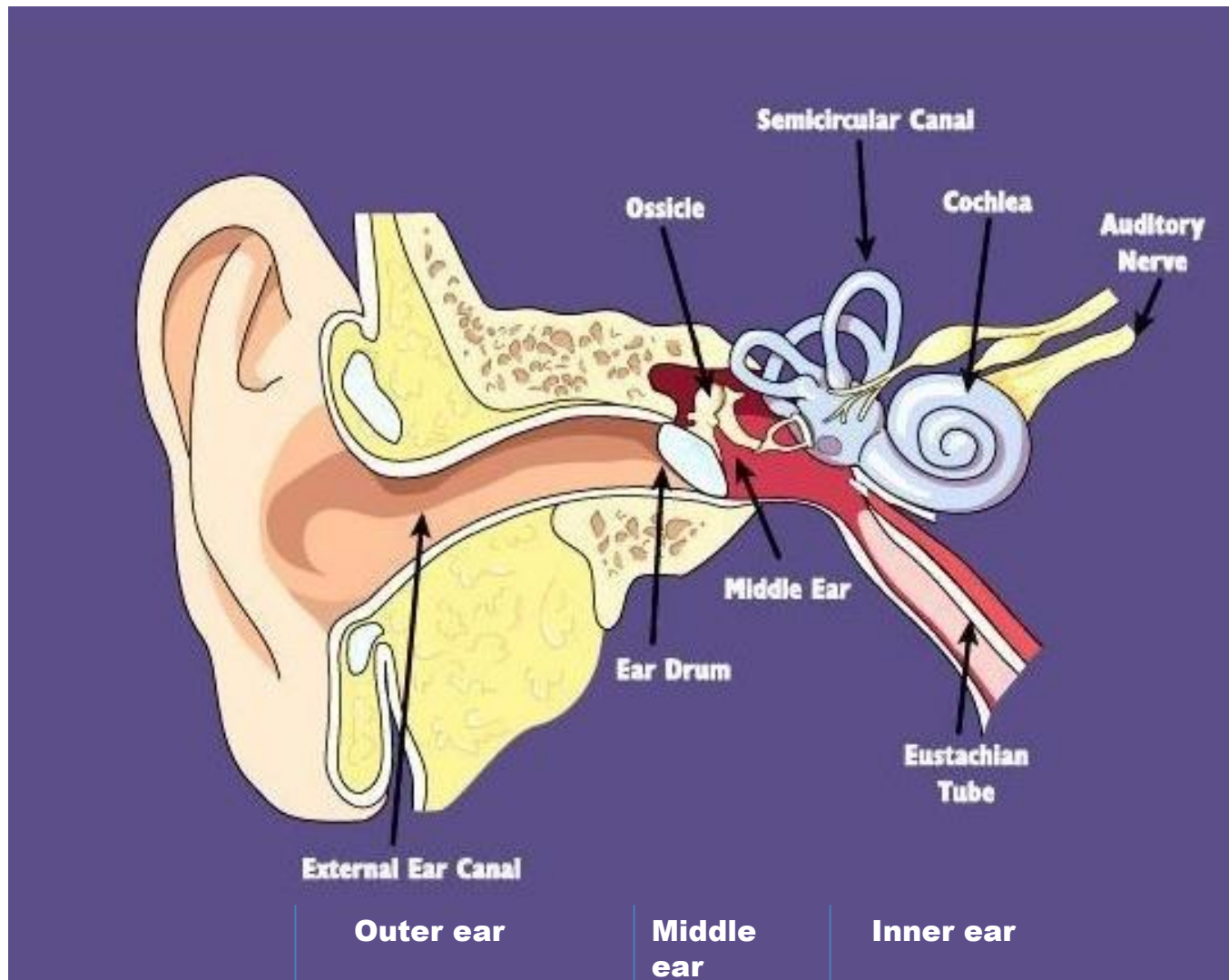
But First...Why?

- Why do we measure sound or even care about potentially hazardous noise levels?
- All your answers may be correct but as a Council for Accreditation in Occupational Hearing Conservation (CAOHC) certified hearing conservationist, our main goal is...

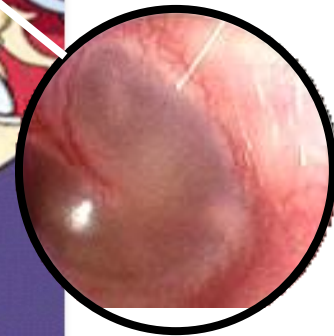
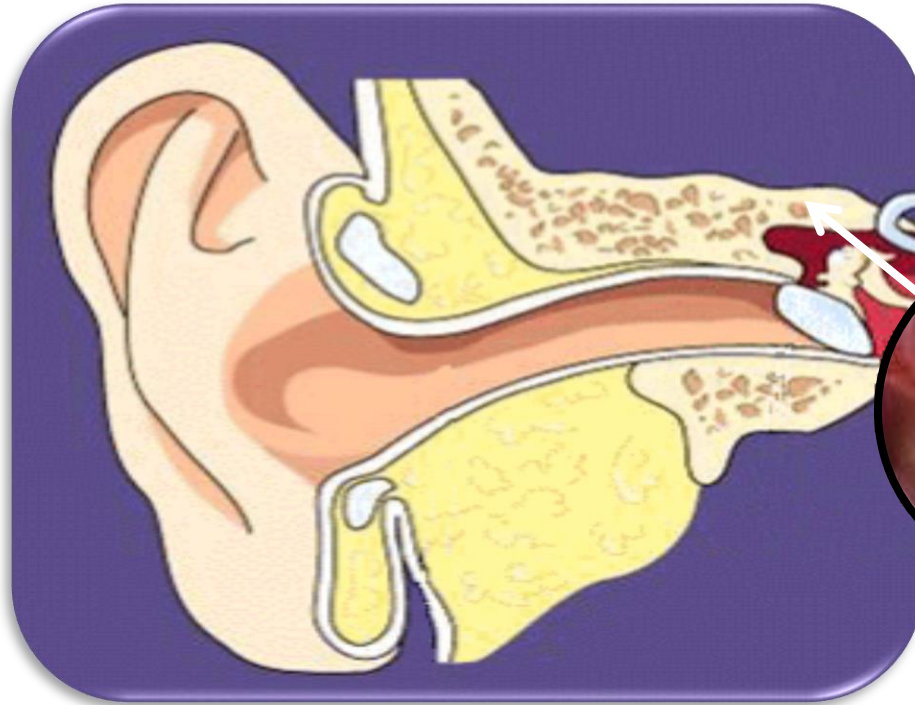
HEARING CONSERVATION



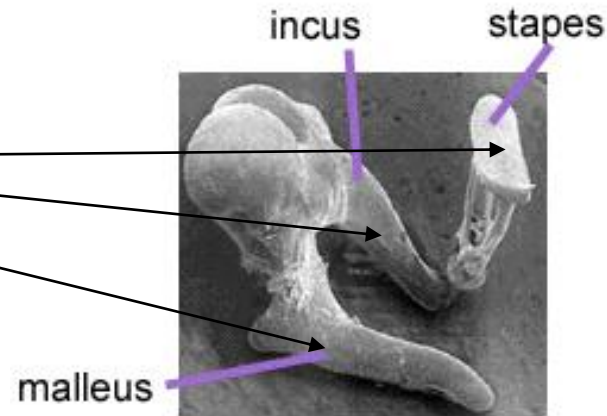
The Human Ear



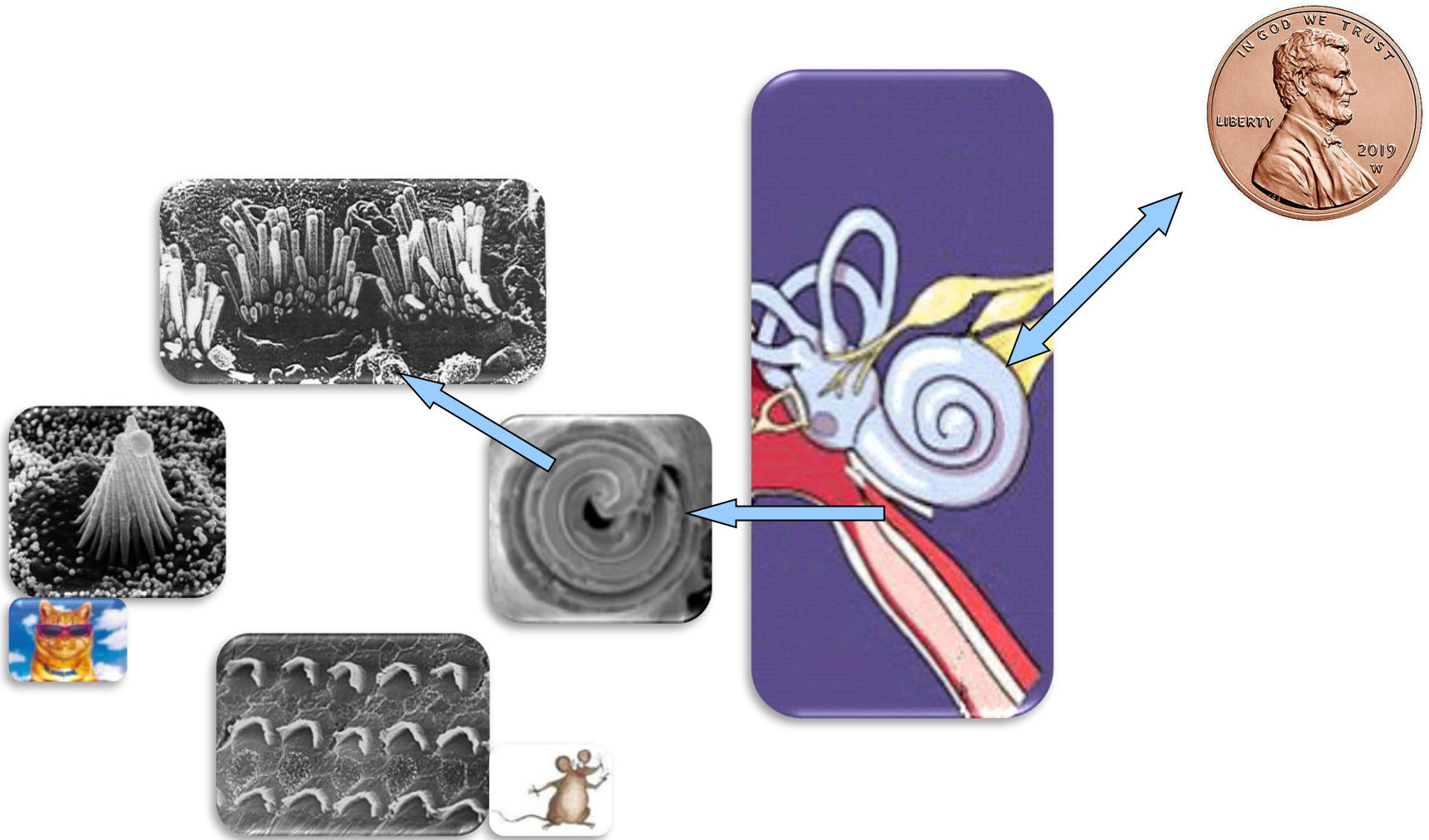
Outer Ear



Middle Ear



Inner Ear



Why?

- Noise is everywhere:



- Hearing loss is one of the most common worker illnesses.

Why?

Workplace injuries are usually noticeable, but...

Workplace noise injuries show up over time



- No blood
- Seldom any pain
- Happens slowly over time

Why?

Hearing loss problems

- Communication
- Entertainment – enjoyment of sound
- Stress
- Relationships



Why?

Productivity

- Hearing well helps workers do jobs effectively.
- Poor communication hinders job completion.



Why?

- Hearing loss is expensive
 - Hearing aids
 - Assistive devices
 - Hearing health care
- Hearing aids do not replace normal hearing



Why?

OSHA-MSHA

- TLV
- TWA
- DOSE



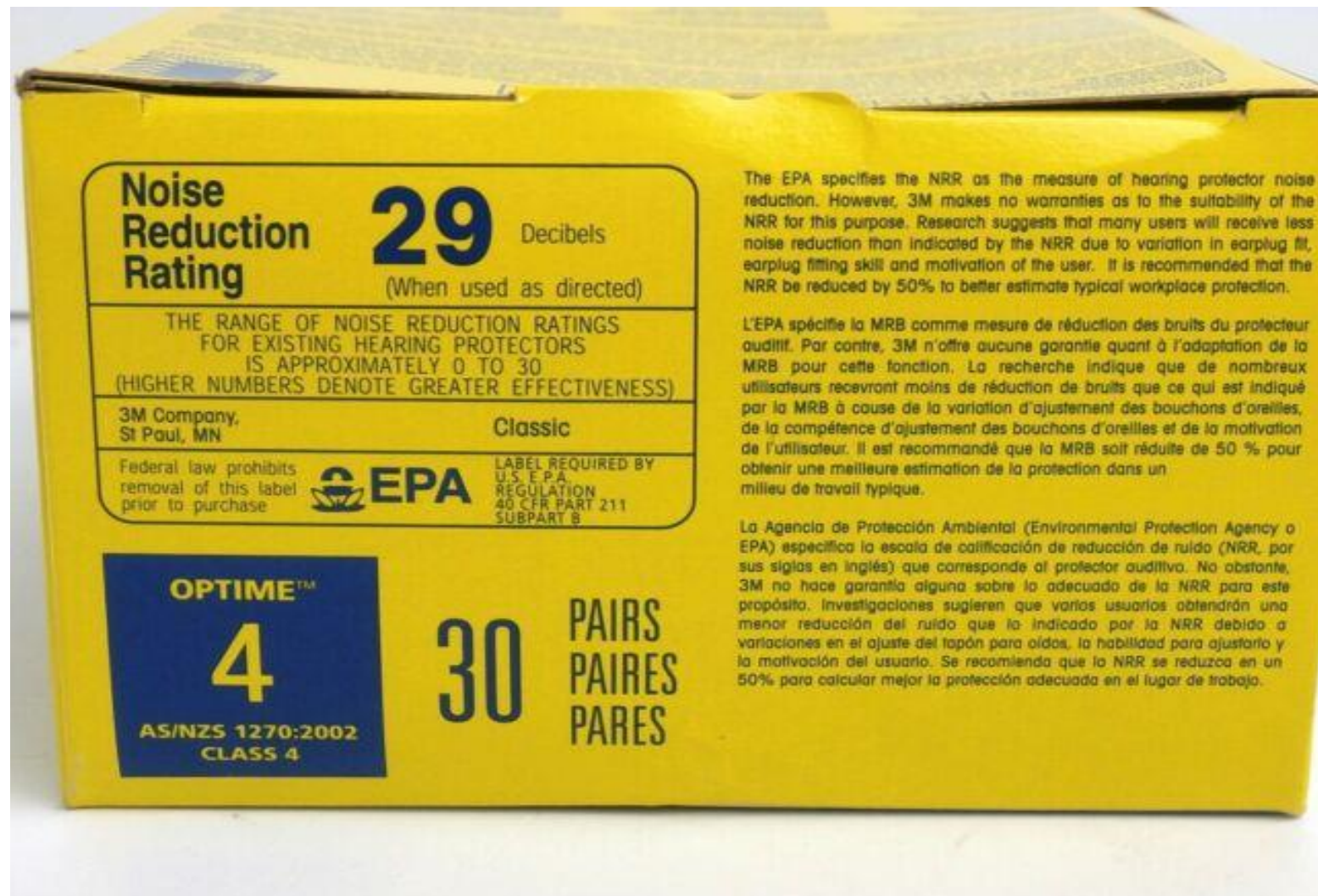
Hearing Protection



Hearing Protection

NRR

Noise Reduction Rating



Hearing Protection

NRR

- 7

2



Key Elements For HCP

1. Hazard Identification (Measuring Sound)
2. Control Methods
 - a. Engineering Controls
 - b. Administrative Controls
3. Hearing Protection Devices
4. Audiometric Testing
5. Hazard Communication and Training
6. Record Keeping

First Item In A Hearing Conservation Program?



**Noise/Sound
Monitoring**

Let's Learn The Basics Of Sound...or Is It Noise?





Four Characteristics of Sound

- Frequency (measured in Hz)
- Intensity (measured in dB)
- Speed (measured in feet or meters/second)
- Wavelength (measured in feet or meters)

Sounds Are Pressure Waves

- Vibrating object releases acoustic energy
- Energy dissipates as pressure waves
- *Sound* is the sensation of pressure waves by auditory system



Sound Level

The sound pressure of **painfully loud sounds** is more than **10 million times greater** than the sound pressure of the **quietest sound** we can hear!



Human Hearing Range



Threshold of hearing

**20
 μPa**

Threshold of pain

**200,000,000
 μPa**

Sound Pressure

0 dB

140 dB

Doubling Sound Source

100 dB



100 dB



+

= 103 dB

- **Add 3 dB**
- **10 dB → perceived as “twice” as loud**

Loudness and SPL

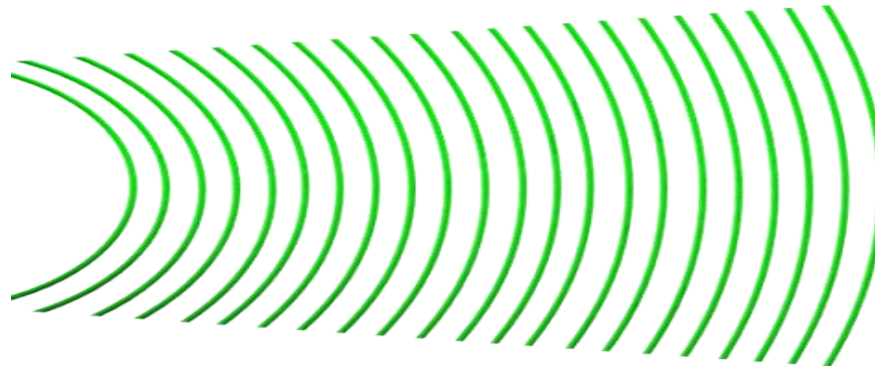
- Intensity / Loudness
 - Decibel
 - 1/10 of a Bel – an Alexander Graham Bell to be precise
 - 1 dB barely audible
 - 3 dB clearly audible
 - Energy doubles at 3
 - Loudness doubles at 10 (Perceived to be)
- Frequency
 - Measured in CPS (cycles per second)
 - Expressed as Hz



Sound Energy

Sound energy decreases over:

- Time
- Distance



1 meter

110 dBA

2 meters

104 dBA

4 meters

98 dBA

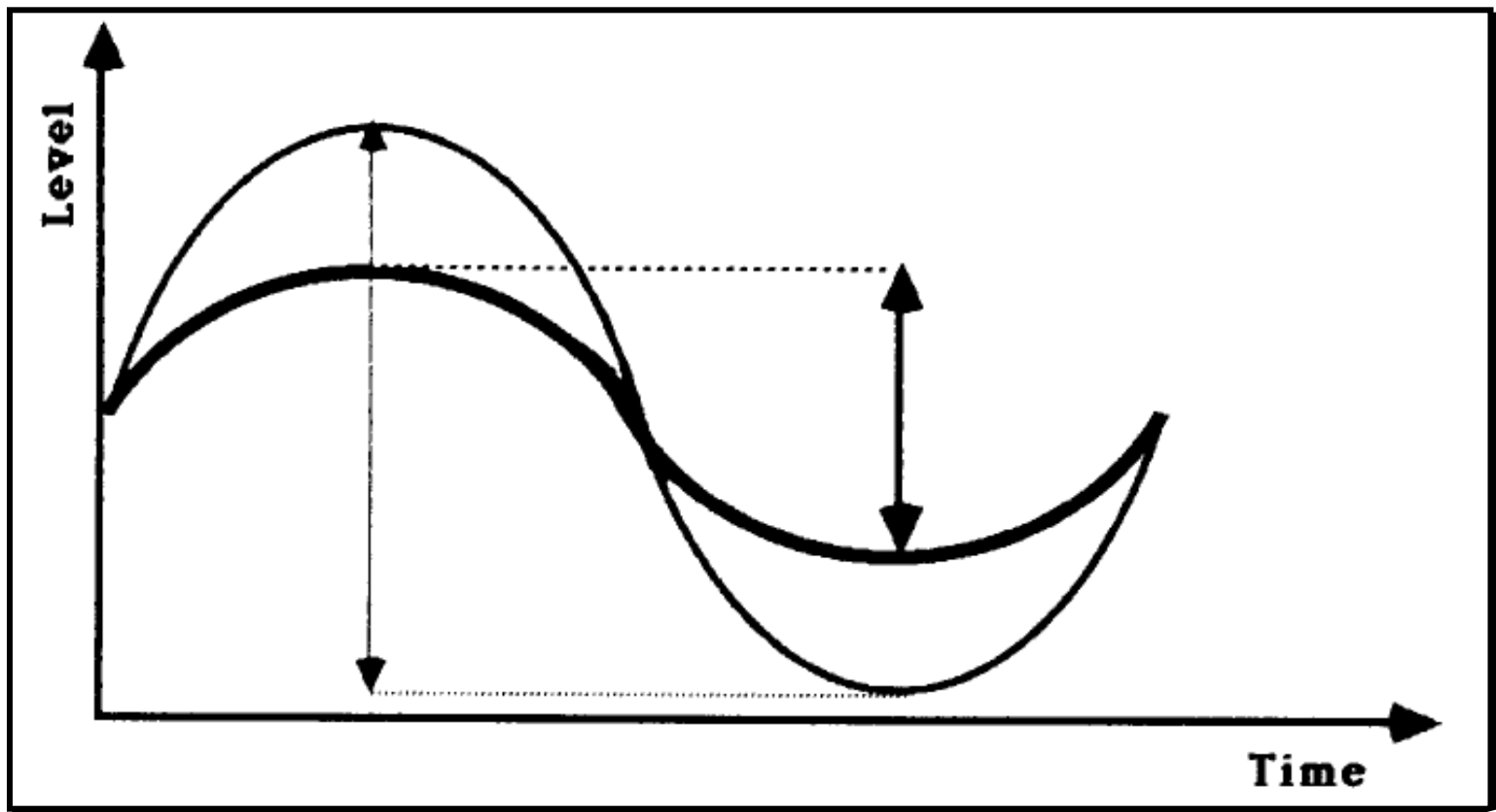
Changing Distance from the Source

- **Outside**
 - Doubling distance
 - Decrease SPL 6 dB
- **Room**
 - Very Near Source
 - Twice the distance decreases SPL by 6 dB
 - Far from source
 - No change with change in distance

NOTE: These are general guidelines. Each case may vary.

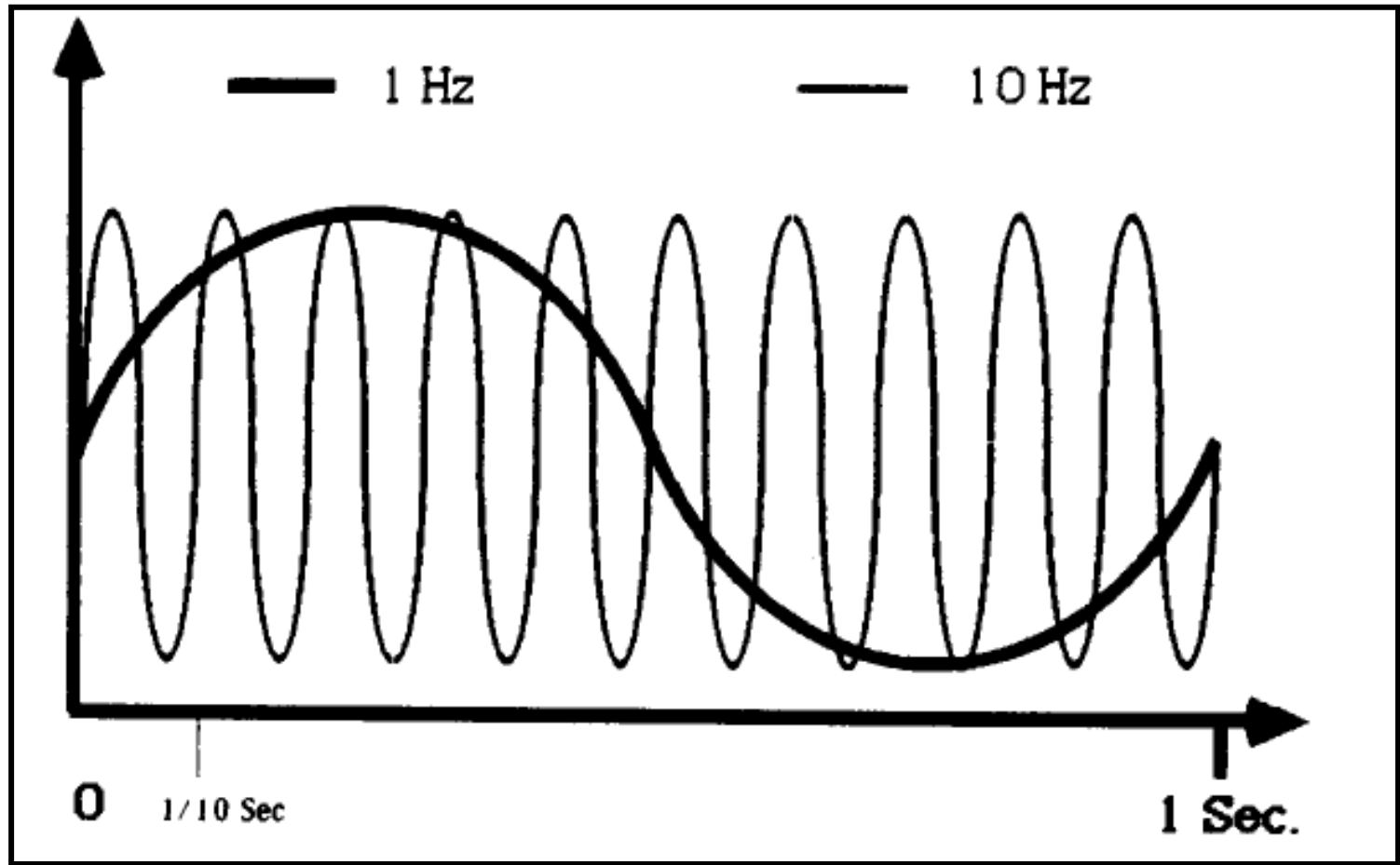
Sound Pressure Level

Sine waves with different sound pressures
measured in decibels (dB)



Frequency

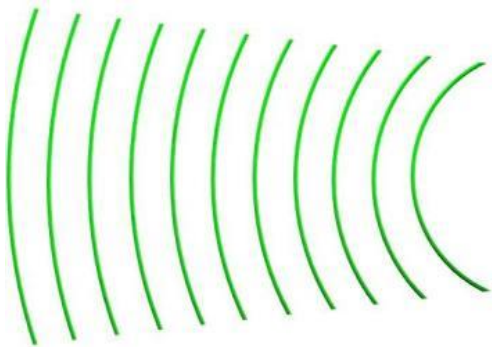
1 Hz and 10 Hz Sine Waves



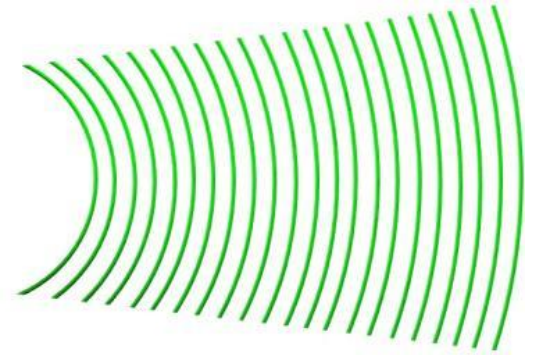
Sound Frequency

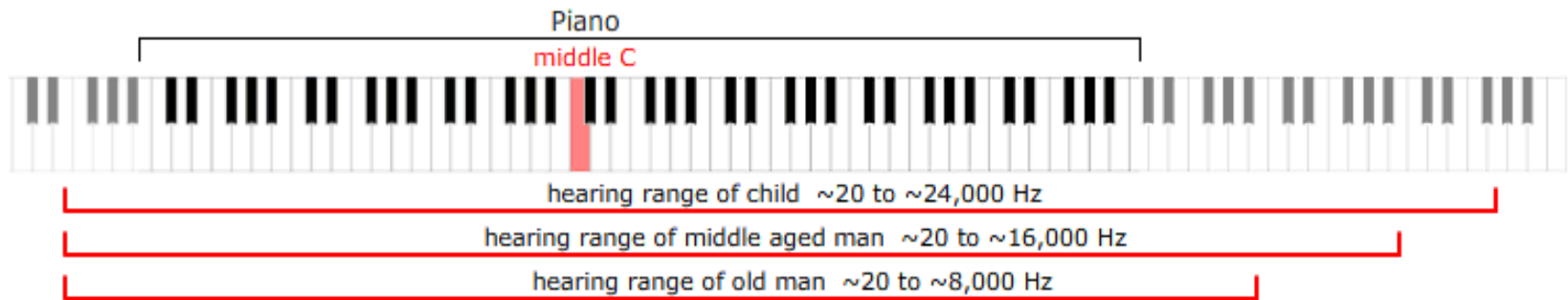
- Sound waves per second **Hertz (Hz)**
- We hear a change in frequency as a change in **pitch**

Low frequency —
fewer waves per
second



High frequency —
more waves per
second



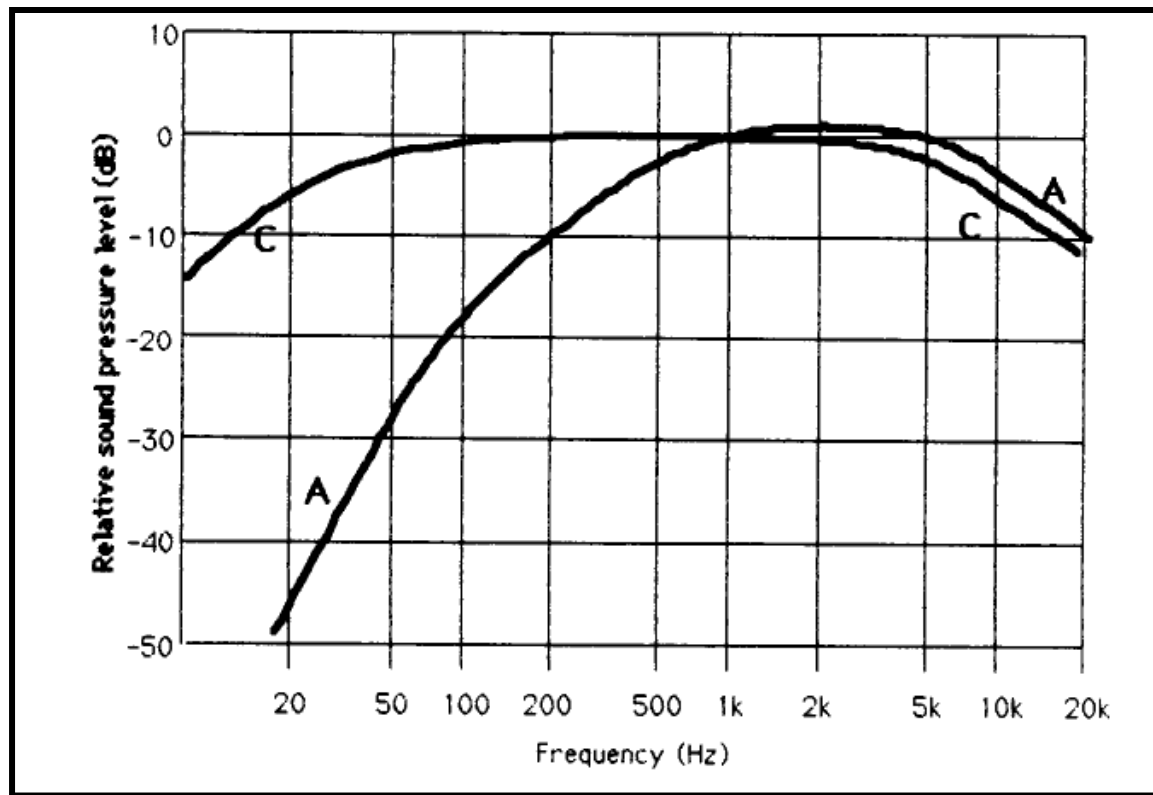


Frequency Response and Weighting

- The human ear is capable of responding to frequencies ranging from 20 Hz to 20 kHz
- The ear is less efficient at high and low frequencies
- In the range from 500 Hz to 4 kHz, a normal human ear is very sensitive

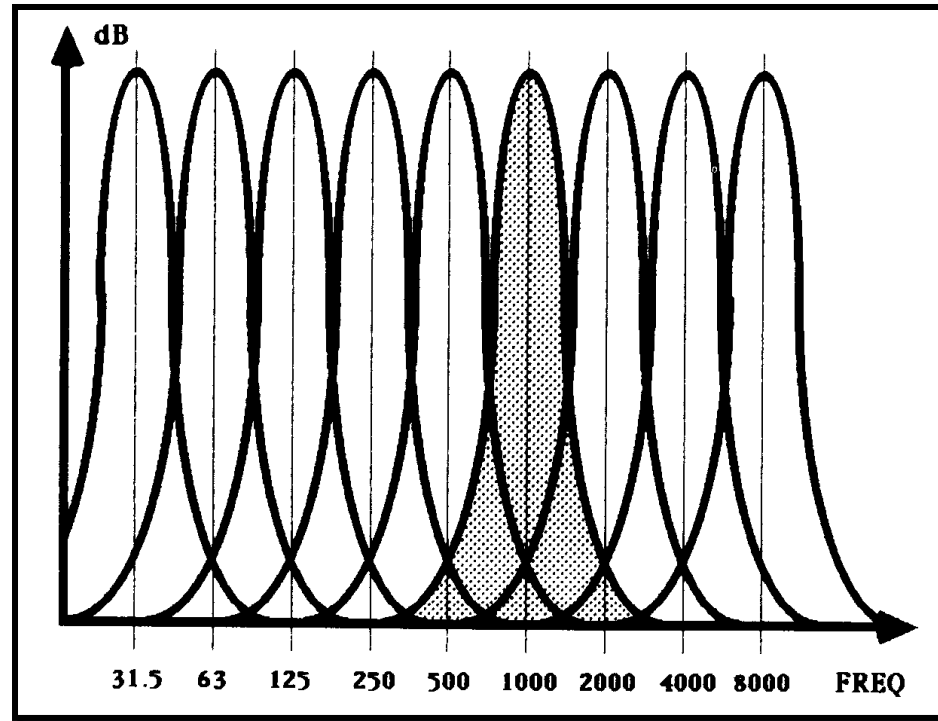
Frequency Response and Weighting

“A” and “C” weighting curves



Octaves

Octave Bands

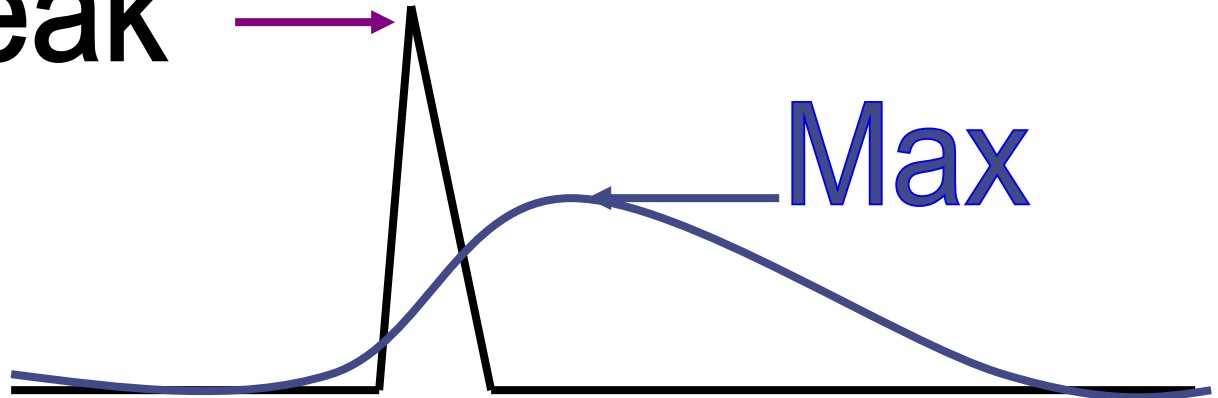
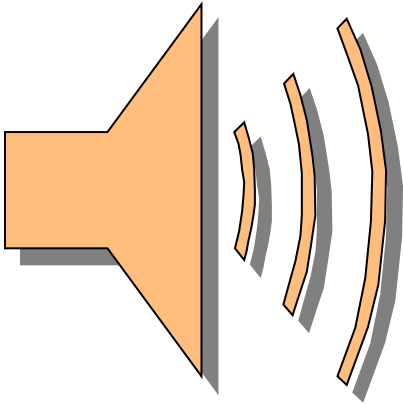


- Focus on the frequency content of the overall noise signal
- Important for noise control efforts

Peak



Max

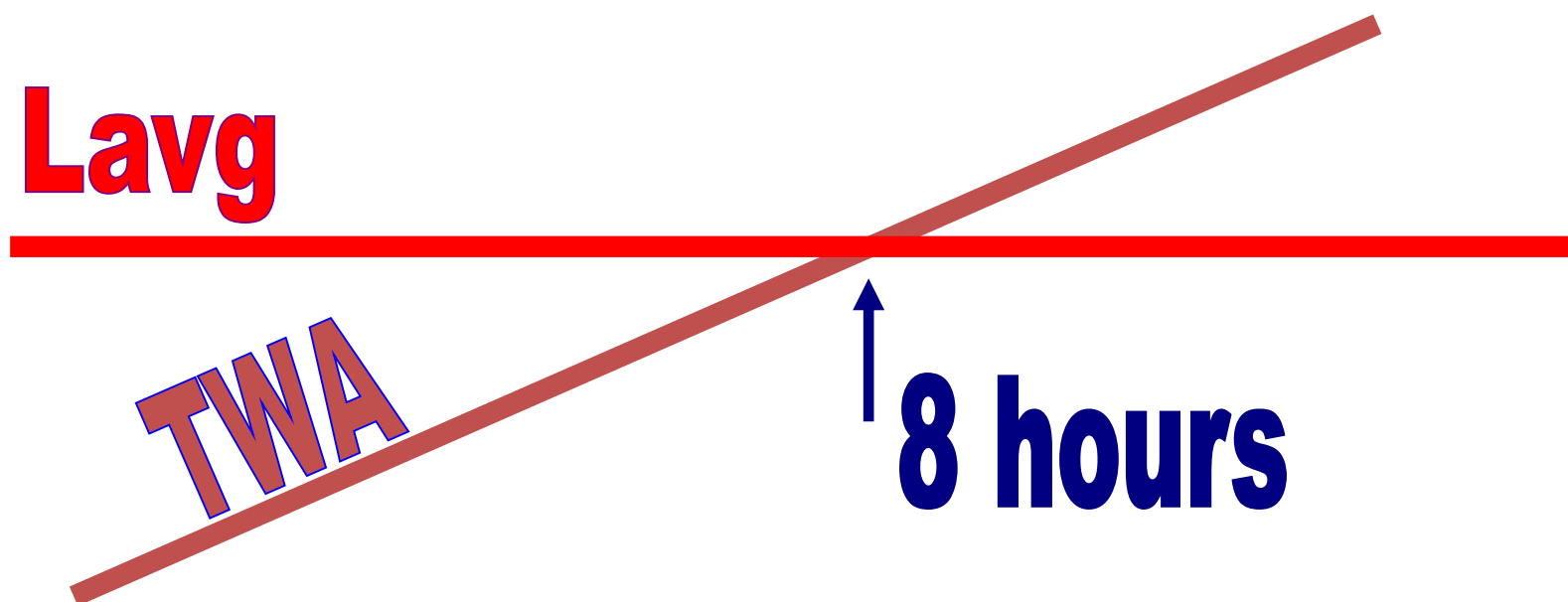


OSHA/MSHA PEAK 140dB
OSHA/MSHA MAX 115dBA

A Basic Concept...

- **TWA** = Lavg at exactly 8 hours
- **DOSE** = Follows the same line!

Lavg



The diagram consists of a horizontal red line and a diagonal red line intersecting. The horizontal line is labeled 'Lavg' in red text above it. The diagonal line is labeled 'TWA' in blue text with a red outline, rotated 45 degrees. A blue arrow points from the text '8 hours' in blue to the intersection point of the two lines.

TWA

8 hours

Exchange Rates

(aka: Doubling Rates)

- **SOUND LEVEL METERS**
 - 3 dB exchange rate
 - When averaged, **Leq** (level equivalent)
- **NOISE DOSIMETERS**
 - 5 dB exchange rate
 - When averaged, **Lavg** (level average)

OSHA/MSHA Regulations



The Occupational Noise Exposure Standard

- Derived from the Walsh-Healey Public Contracts Act
- 1971 adopted under the Occupational Safety and Health Act
- Permissible Exposure Level (PEL) of 90 dBA
- Noises with a higher level than 90 dBA can be sustained for periods of less than 8 hours
- Sounds with average levels less than 90 dBA can persist for periods of more than 8 hours

Permissible Noise Exposure

Hours per Day	Sound Level dBA slow response
8	90
6	92
4	95
2	100
1.5	102
1	105
0.5	110
0.25 or less	115

Hearing Conservation Amendment

- Published in the Federal Register on March 8, 1983
- The Hearing Conservation Amendment requires the employer to perform five key tasks:
 - Measure Noise
 - Audiometric Tests
 - Hearing Protectors
 - Education and Training
 - Record Keeping

Table G-16a (abbreviated)

	A-Weighted Sound Level	Duration (Hours)
Measuring Threshold	80	32
H.C. Action Level (50% exp.)	85	16
8 Hour Criteria	90	8
	95	4
	100	2
	105	1
	110	0.5
	115	0.25
	120	0.125
	125	0.063
Minimum Upper Range	130	0.031

Measuring Method for OSHA/MSHA Surveys

	Original Rule	H.C.A.
Weighting/Response	A/Slow	A/Slow
Exchange (Doubling) Rate	5 dB	5 dB
Criterion (LC=100%)	90 dB	90 dB
Threshold (Cut Off)	90 dB	80 dB
Limit	90 dB/100%	85 dB/50%
	(PEL)	Action Level

No.1 Question Asked about Monitoring

How often must I measure sound?

Employers must repeat monitoring whenever changes in production, process, or controls increase noise exposures.

Conclusion

- The focus of the Occupational Noise Exposure Standard and the Hearing Conservation Amendment is to set minimum requirements to protect hearing for those workers in a noisy environment.
- The Keys to Success
 - Positive attitude on the part of the management
 - Clear communication on the value of hearing
 - Hearing protection takes care of the problem of noise for the short term, but the key to real hearing protection is education and communication.

Critical Terminology

- Level Average (LAVG) – If present continuously, would generate the same amount of energy as the varying levels that are present in the environment measured in decibels
- Equivalent Level (Leq) – As above, assuming 3 dB exchange rate and no threshold
- Time Weighted Average (TWA) – A level average with an assumed fixed sample period of eight hours measured in decibels
- Dose – The allowable daily exposure value. A maximum allowable exposure is equal to 100% dose.
 - $(90 \text{ dB} \times 8 \text{ hrs} = 100\% \text{ dose})$ $(85 \text{ dB} \times 8 \text{ hrs} = 50\% \text{ dose})$
- Projected Dose – A “what if” dose calculation that assumes exposure conditions will continue as they were

Critical Terminology

- Maximum Level (L_{max}) – The highest weighted slow level measured during sample period
 - Pertains to ceiling level
 - US OSHA 115 dBA
- Minimum Level (L_{min}) – The lowest weighted slow level measured during sample period
- Peak Level (L_{pk}) The highest unweighted, fast response sound level measured during sample period
 - US OSHA 140 dB

Critical Terminology

- Criterion - If exposed to SPL on average for eight hours, it would result in a maximum allowable exposure.
- Threshold - For OSHA and MSHA purposes these are set at 80dB for Hearing Conservation and 90dB for PEL. Any Sounds below these set values are recorded as ZERO.
- Exchange Rate - Results in a doubling or halving of the maximum allowable exposure.

Noise Dosimeters



Environmental Concerns

- Temperature
- Humidity
- Atmospheric Pressure
- Wind
- Radio Frequency Interference
- Magnetic Interference



Noise Survey – key steps

- Check Battery
- Calibrate
- Inform Worker
- Place Unit/Microphone
- Leave It Alone
- Normal Work Tasks
- Check It
- Observe
- Remove Unit
- Post Calibrate
- Record Data

Noise Dosimeter Placement Video



What to Record in Addition to Sound Levels

- Dates and Times
- Model and Serial Numbers
- Pre and Post Survey Calibration Levels
- Workplace Descriptions
- Task Descriptions
- Environmental Factors
- Instrument Settings
- Unusual Conditions

Survey Pitfalls

- Microphone Placement
- Employee
- Project Assumption
- Threshold Distortion
- Wind
- Battery and Calibration



Physical Components and Characteristics

History button

On screen or on PC App

Next and Previous buttons

Cycle through screen

Green Button

Power on, "yes", select

Clothing clip

Type 2 Microphone, Windscreen

Lock and Unlock feature

Multipurpose LED Collar

Voice Recording Button

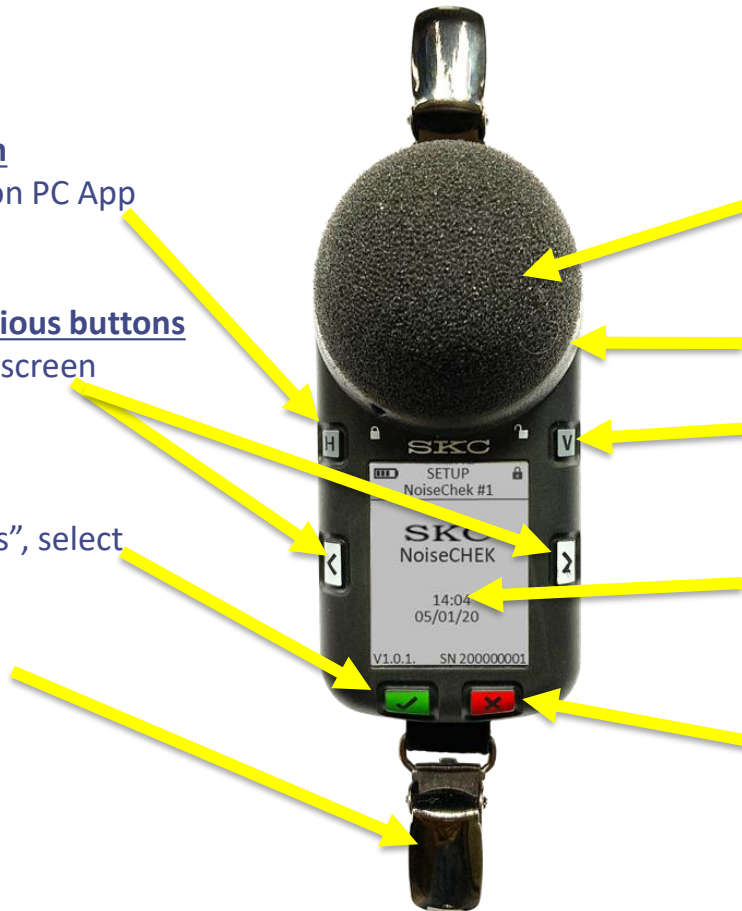
User created voice tags

Display Screen

Largest on a cable-free dosimeter

Red Button

Power off, "No"



Physical Components and Characteristics

Battery and Run time

- Lightweight Li-ion Polymer
- 40+ hours of run time
- 4-6 hours charge time



Charger

- Easy to use Docking Station
- Magnetic Docking for stability
- 110/220 VAC
- USB output
- Single and 5-unit Docking Station



Basic Operation

Turning on:

Press the **Green Button** until the home screen comes on



Basic Operation

Turning on:

Press the **Green** Button until the home screen comes on

Turning off:

When not running; Press the **Red** button until the confirmation screen appears. Press the **Green** button to confirm.



Basic Operation

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Press the **Green** Button until the home screen comes on

Turning off:

When not running; Press the **Red** button until the confirmation screen appears. Press the **Green** button to confirm.

Viewing Parameters:

Press the next or previous buttons to cycle through the parameters for all 4 internal dosimeters



Basic Operation

Turning on:

Press the **Green** Button until the home screen comes on

Turning off:

When not running; Press the **Red** button until the confirmation screen appears. Press the **Green** button to confirm.

Viewing Parameters:

Press the next or previous buttons to cycle through the parameters for all 4 internal dosimeters



Calibration

- Assure that the unit is not running
- Remove Windscreen
- Assure that the calibrator is set for 114 dB @ 1000 Hz
- Slide the calibrator onto the microphone until it stops
- NoiseChek will automatically detect the presence of the calibrator



Calibration

- Assure that the unit is not running
- Remove Windscreen
- Assure that the calibrator is set for 114 dB @ 1000 Hz
- Slide the calibrator onto the microphone until it stops
- NoiseChek will automatically recognize the presence of the calibrator
- 5 second count down to allow user to abort



Calibration

- Assure that the unit is not running
- Remove Windscreen
- Assure that the calibrator is set for 114 dB @ 1000 Hz
- Slide the calibrator onto the microphone until it stops
- NoiseChek will automatically recognize the presence of the calibrator
- 5 second count down to allow user to abort
- Calibration will begin automatically after 5 seconds



Calibration

Pass

- Screen will display “PASSED 1 kHz”
- “Before” dB level is the reading before adjustment
 - Serves as a post-calibration to previous run(s)
- “After” dB level is the adjusted reading
 - Serves as calibration for next run(s)
- Adjusted amount shown for documentation and trending
- Remove calibrator and press the **Green** button to accept
- Replace Windscreen

Fail

- Screen will display “Calibration Failed”
- User will be able to discard and retry



Calibration Video



Calibration

- Before use (Pre-Calibration)
- After Use (Post-Calibration)



Basic Operation

Running/Recording:

- Press and hold the Green button until the confirmation screen appears



Basic Operation

Running/Recording:

- Press and hold the **Green** button until the confirmation screen appears
- Press the **Red** button to cancel and return to the main screen
- Press the **Green** button and the run will start
 - Selected data will be shown
 - Exposure LED's begin to flash.



Basic Operation

Running/Recording:

- Press and hold the **Green** button until the confirmation screen appears
- Press the **Red** button to cancel and return to the main screen
- Press the **Green** button and the run will start
 - Selected data will be shown
 - Exposure LED's begin to flash.
- Use the Next and Previous buttons to view additional dosimeter readings if present



Basic Operation

Octave Bands:

- Viewable for each virtual dosimeter
- Viewable in Run mode
 - Must be programmed in DataTrac dB software

Why Octave Bands in a Dosimeter?

- PPE determination and selection
- Engineering controls
- Determining noise source



Basic Operation

Pausing the Run:

- Press and hold the **Green** button until the confirmation screen appears.



Basic Operation

Pausing the Run:

- Press and hold the **Green** button until the confirmation screen appears.
- Press the **Green** button again to accept.



Basic Operation

Pausing the Run:

- Press and hold the **Green** button until the confirmation screen appears.
- Press the **Green** button again to accept.
- Run can be resumed by pressing and holding the **Green** button again and selecting yes.



Basic Operation

Pausing the Run:

- Press and hold the **Green** button until the confirmation screen appears.
- Press the **Green** button again to accept.
- Run can be resumed by pressing and holding the **Green** button again and selecting yes.



Basic Operation

Pausing the Run:

- Press and hold the **Green** button until the confirmation screen appears.
- Press the **Green** button again to accept.
- Run can be resumed by pressing and holding the **Green** button again and selecting yes.

Stop Run:

- Press and hold the **Red** button until the confirmation screen appear.



Basic Operation

Pausing the Run:

- Press and hold the **Green** button until the confirmation screen appears.
- Press the **Green** button again to accept.
- Run can be resumed by pressing and holding the **Green** button again.

Stop Run:

- Press and hold the **Red** button until the confirmation screen appear.
- Press the **Green** button to accept.



Basic Operation

History Feature:

- Sample is stopped
- Automatically placed in History
- Use right arrow to view last run
- Press the 'H' button to exit history



Additional Functions

History Feature:

- Press the 'H' button to see past recordings by date and time.
- Use the Previous and Next buttons to cycle to the record to be viewed
- Press the **Green** button to select a record and view all pertinent data for all virtual dosimeters



Additional Functions

History Feature:

- Press the 'H' button to see past recordings by date and time.
- Use the Previous and Next buttons to cycle to the record to be viewed
- Press the **Green** button to select a record and view all pertinent data for all virtual dosimeters
- Press the 'H' button to exit the history



Basic Operation

Voice Note Feature:

- Press and hold the 'V' button to record a voice note to be assigned to a noise recording.
 - White LED will flash to indicate a stored voice note



Basic Operation

Voice Note Feature:

- Press and hold the 'V' button to record a voice note to be assigned to a noise recording.
 - White LED will flash to indicate a stored voice note
- Press the 'V' button again to stop the recording



PC App (Software)

DataTrac dB

Connected devices

Rescan

A. Bragg - Demo

Save Setup to this device

Setup Schedule History

Select up to nine readings to show on the device during a run

☒ SPL ☐ Lmin ☐ C-A
☒ TWA ☐ Exposure ☐ LEP,d
☒ Dose ☒ pTWA ☐ LEX,8h
☒ Lavg ☒ pDose ☐ Exposure Pts
☒ Peak ☐ SEL ☐ Exposure Pts/Hr
☒ Lmax ☒ Upper Limit

Select up to seven readings to show on the device in History

☐ SPL ☐ Lmin ☐ C-A
☒ TWA ☐ Exposure ☐ LEP,d
☒ Dose ☐ pTWA ☐ LEX,8h
☒ Lavg ☒ pDose ☐ Exposure Pts
☒ Peak ☐ SEL ☐ Exposure Pts/Hr
☒ Lmax ☒ Upper Limit

Set other options on the device

☒ Display octave bands ☒ Log data
☐ Log octave band data

Peak Weighting

☒ Secure Lock
Require PIN to connect to mobile app

PIN

☐ Auto Lock
Require PIN to stop or pause

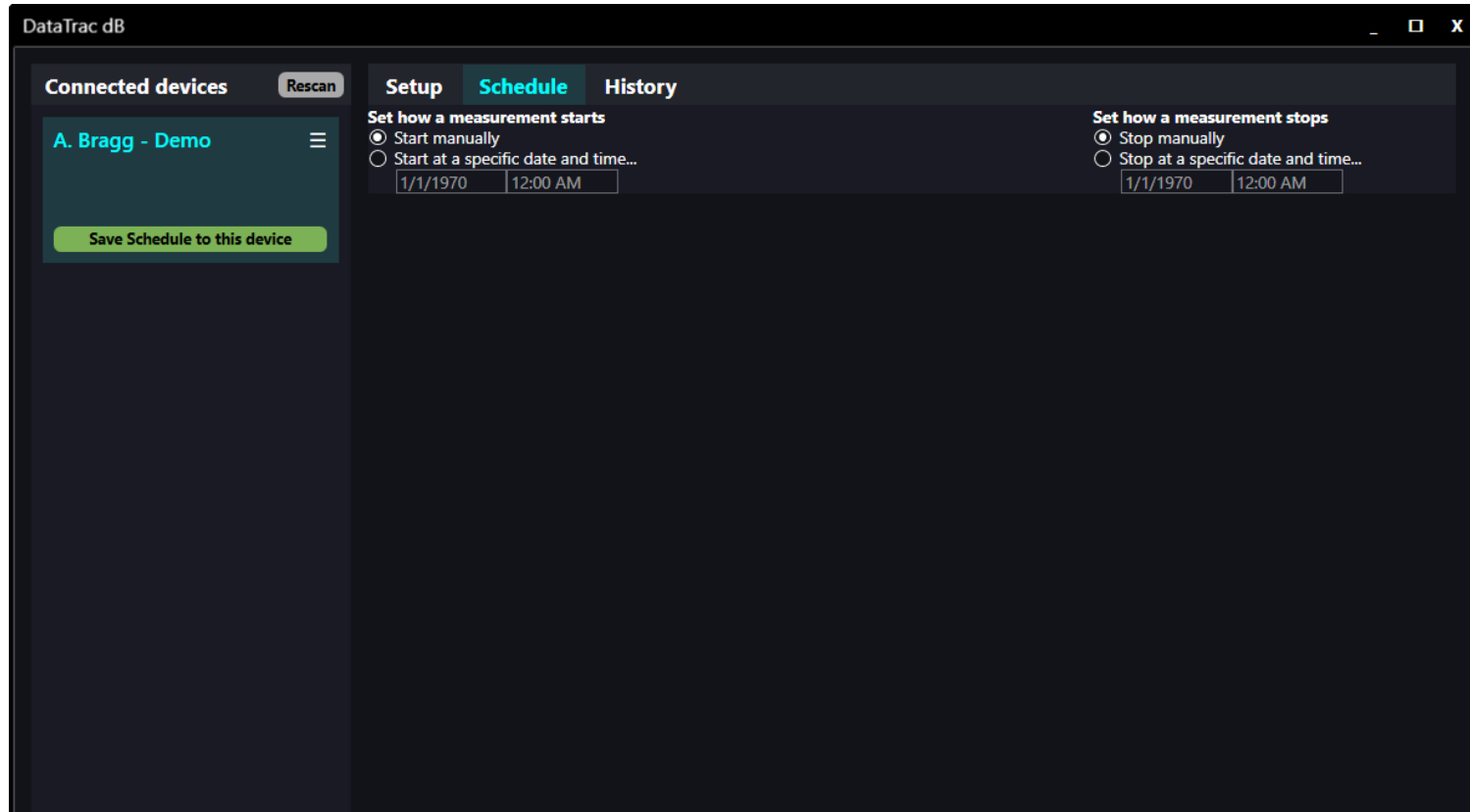
Enable and define up to four separate virtual dosimeters for each run

OSHA - HC	OSHA - PEL	ACGIH	MSHA - HC
Response: Slow	Response: Slow	Response: Slow	Response: Slow
Exchange Rate: 5 dB	Exchange Rate: 5 dB	Exchange Rate: 3 dB	Exchange Rate: 5 dB
Threshold: 80 dB	Threshold: 90 dB	Threshold: 80 dB	Threshold: 80 dB
Criterion Level: 90 dB	Criterion Level: 90 dB	Criterion Level: 85 dB	Criterion Level: 90 dB
Weighting: A	Weighting: A	Weighting: A	Weighting: A
Upper Limit: 115 dB	Upper Limit: 115 dB	Upper Limit: 115 dB	Upper Limit: 115 dB

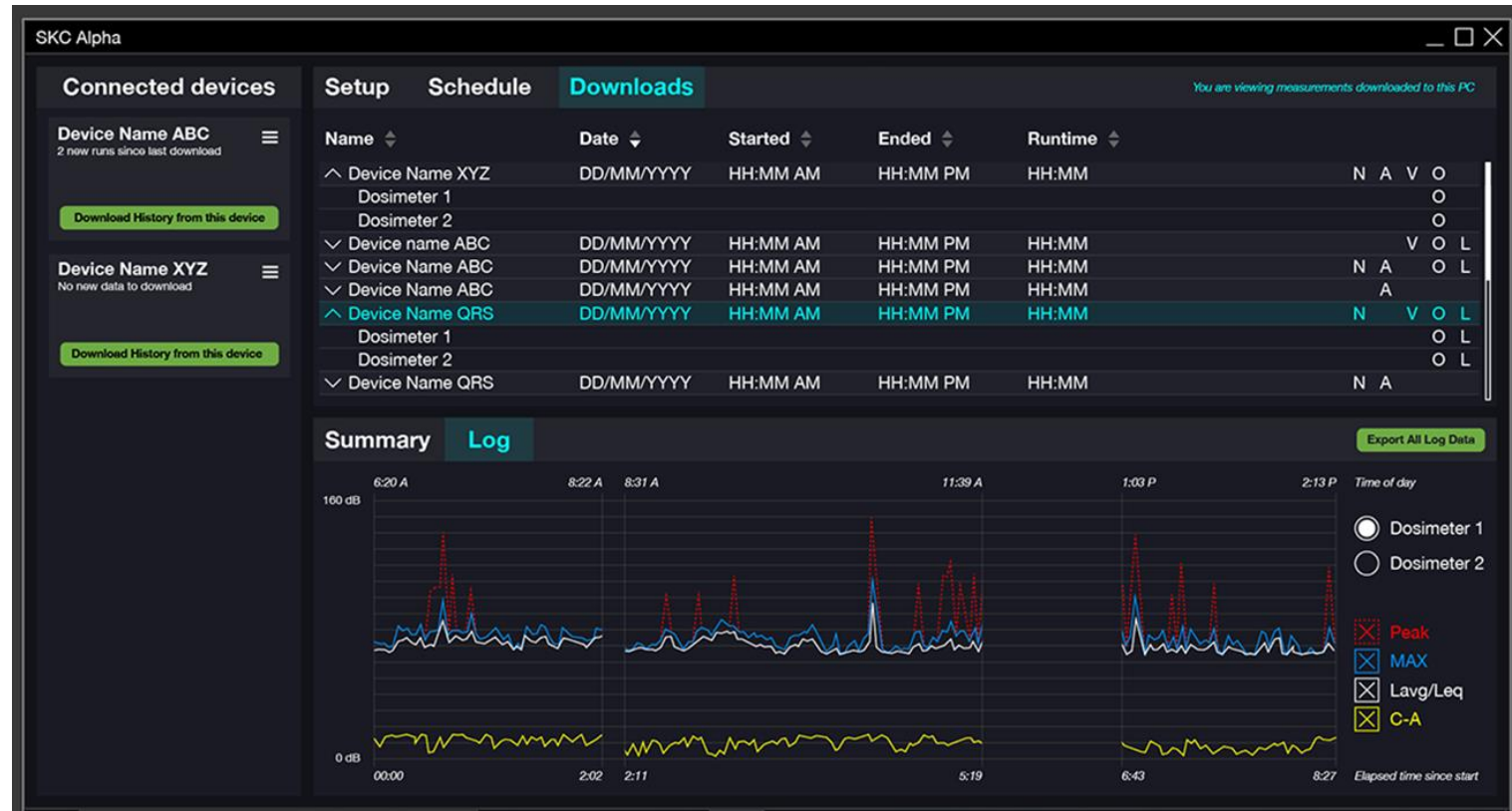
Auto-record above dB (0 to disable)

Alert at % Dose (0 to disable)

PC App (Software)



PC App (Software)



Mobile App



SKC

Sample date: 5/8/2020 8:11 PM
 Title: Chipper / Grinder
 Company: AB Wood Mill
 Location: Jefferson GA
 Comments: Jake Thompson
 Device Name: Andy's Demo 2112
 Dosimeter Count: 4

Measurement Parameters:

	Dosimeter 1	Dosimeter 2	Dosimeter 3	Dosimeter 4
Setup Name:	OSHA - HC	OSHA - PEL	ACGIH	MSHA - HC
Response:	Slow	Slow	Slow	Slow
Threshold:	80dB	90dB	90dB	80dB
Upper Limit:	115dB	115dB	115dB	115dB
Exchange:	5dB	5dB	3dB	5dB
Criterion Lev:	90dB	90dB	90dB	85dB
RMS Weighting:	A	A	A	A
Lavg/Leq:	Lavg	Lavg	Lavg	Leq

Session Summary Data:

Session Started: 5/8/2020 8:11 PM
 Session Run Time: 01:40

	Dosimeter 1	Dosimeter 2	Dosimeter 3	Dosimeter 4
Setup Name:	OSHA - HC	OSHA - PEL	ACGIH	MSHA - HC
TWA:	44.8 dB	43.7 dB	66.7 dB	44.8 dB
Dose:	0.2 %	0.2 %	0.5 %	0.4 %
Lavg:	85.7 dB	84.5 dB	91.3 dB	91.5 dB
Peak:	120.9 dB	120.9 dB	120.9 dB	120.9 dB
Max:	107.5 dB	107.5 dB	107.5 dB	107.5 dB
PDose:	54.9 %	46.7 %	133.9 %	109.8 %
Upper:	0.0 sec	0.0 sec	0.0 sec	0.0 sec

PreCal Date: Friday, May 8, 2020 8:11 PM
 PreCal Level: 114.0 dB
 PostCal Date: Friday, May 8, 2020 8:14 PM
 PostCal Level: 114.0 dB

Report Generated: Wednesday, May 13, 2020

Page 1 of 1

Re-monitoring

Change in process or procedure that affects inclusion and/or hearing protection effectiveness

- Production rates
- Material processed
- Production technique
- Machine placement



Quick Video Access

- Short or “Quick” Videos
 - SKCInc1 – YouTube
 - Calibration, Run, and Review 2:27
 - Setting up and Programming Virtual Dosimeters 0:51
 - Setting up a Scheduled Run 0:45
 - Always know where you stand – LED demo 2:04
 - Screen and Menu Navigation 2:47
 - SmartWave dB Mobile App 4:13
 - Ideal Placement 1:21





Andy Bragg
Director of Sales
SKC Inc.



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